Public Health Reports

UME 66 JULY 6, 1951 NUMBER 27

TUBERCULOSIS CONTROL ISSUE NO. 65

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FEDERAL SECURITY AGENCY

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This is the sixty-fifth of a series of special issues of PUBLIC HEALTH REPORTS devoted exclusively to tuberculosis control. The special issues began March 1, 1946, and appear the first week of each month. The articles are reprinted as extracts. Effective with the July 5, 1946, issue, these extracts may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents a single copy. Subscriptions are obtainable at $1.00 per year, $1.25 foreign.

Public Health Reports

Vol. 66 • JULY 6, 1951 • *No. 27*

—Editorial—

Research in Mass Radiography

The discovery of the X-ray by Roentgen in 1895 provided a greatly improved way of identifying the silent, insidious process of tuberculosis before it had developed into open and often intractable disease. The photofluorograph, when it came into use some 40 years later, made possible the application of X-ray to mass case finding and opened the way to a new and aggressive campaign against tuberculosis.

Because we have had this diagnostic tool, countless lives have been saved, but our use of X-ray to find tuberculosis admittedly has limitations, some of which are not yet fully understood. Some of these arise from the variability of interpretation, others from the variable patterns of the disease itself and from our lack of fully definitive knowledge of the disease process.

Having been convinced by the experiences of industrial and segmental surveys that the value of photofluorography in detecting tuberculosis far outweighed the shortcomings, the Public Health Service launched its program of community-wide mass chest X-ray surveys 5 years ago. At the same time, however, the Service undertook an extensive research program seeking fuller knowledge of both the advantages and the limitations of mass radiography. In Columbus, Ga., a study was organized to assay the effects of the community-wide chest X-ray survey on the control of tuberculosis. Concurrently, at the Central Cooperative Clinic in Philadelphia, another investigation was undertaken to follow the health history of tuberculosis suspects discovered in mass surveys. These research facilities have had the common purpose of providing the knowledge which will sharpen and refine mass X-ray survey operations.

This kind of research is of necessity a long-term undertaking, but the work is now producing results. In last month's Tuberculosis Control Issue of Public Health Reports, the third of a series of reports from the Columbus, Ga., study was presented. The current issue carries a description of the Philadelphia Central Cooperative Clinic study which forms the first of a series of reports from that installation. In the Columbus study, tuberculin-test data, resurvey

X-ray films, and physical examination findings are now available which, in combination with detailed information about the development of tuberculosis in the area, should help to clarify the "endogenous-exogenous" controversy over the nature of tuberculosis. In the Philadelphia study, careful observation and detailed physical findings over a prolonged period of follow-up will be correlated with initial X-ray findings to give a clear understanding of the latter's significance. Such results should provide a more precise basis for the intensive follow-up of those persons whose continued medical supervision following their discovery in X-ray surveys would appear to be most profitable and necessary, both for the individual and for the public health.

Such problems demand painstaking work, careful observation, and detailed analysis. It is hoped that these studies will provide scientific knowledge which will enable us to retain the advantages of the mass chest X-ray survey and to minimize its limitations.

ROBT. J. ANDERSON,
Medical Director,
Chief, Division of Chronic Disease and Tuberculosis.

Central Cooperative Clinic Study of Follow-Up in Tuberculosis Control

I. Background, Objectives, and Methodology

By Donald Ottenberg, M.D., Katharine Boucot, M.D., W. Edward Chamberlain, M.D., Louis Cohen, M.D. and Sara E. Yelton, M.A.*

The intensified search for tuberculosis in the apparently healthy population is burdened with perplexing problems related to disposition of the survey-discovered case. Although physicians recognize the challenge of the "silent" lesion they have as yet few guides to help them meet it.

In 1949, over 14 million individuals were screened by photofluorographic surveys in the United States, and about 200,000 had lesions "suspicious" of tuberculosis. The size of the group requiring diagnosis and counsel in a single year of case-finding activities, emphasizes the need for refined criteria for selection and disposition of persons found. The problem is an old one but seems somehow to take on new proportions when large numbers are surveyed and when one attempts to arrive at reasonably objective criteria for their management.

The problem of assessing the significance of many of the lesions encountered in surveys is present from the beginning of the survey until final disposition of the discovered patients. The uncertainty first appears with the initial question: "Who among the individuals surveyed should be referred to a physician for further study?" Since the shadows visible on X-ray films may range from the barely perceptible to the very obvious, it is necessary to select from a relatively large number those that are thought to require further investigation. At present, this selection is a somewhat arbitrary activity. Readers can separate the survey population into positives and negatives only imperfectly because of the difficulty in defining a lesion, and yet there is no thoroughly documented follow-up experience from which to formulate this definition. Furthermore, not only is the basis of selection likely to be different from one reader to another, but each reader has a limited ability to select patients consistently on the basis of

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his own criteria. Errors of omission and commission are therefore inevitable. Persons who should be referred for clinical study may be advised that they are free of disease, while others may be needlessly subjected to psychological trauma and wasted effort.

The physician to whom the survey-discovered patient is referred may find himself in an even more disturbing position than the interpreter of the survey film. He is confronted by a patient, not a film, and the patient's question, "What does the shadow on my X-ray mean?" The answer may influence the entire life of the patient and his family, and it must be given with conviction. Yet the physician has meager information on which to proceed. The results of his examination, no matter how thorough, will be essentially negative in the majority of patients, and his accumulated knowledge of the probable course of clinically manifest disease provides but a hypothetical basis for his advice to the patient with unsuspected disease. The physician knows that nothing will reassure the anxious patient better than prompt dismissal, but the possible consequences of such a decision are all too clear. Most physicians resolve this dilemma by advising periodic observation, a choice much more difficult for the patient to accept and for the physician to enforce. Although this course satisfies the desire of the physican to serve the interests of both the patient and the community, he frequently is faced with further difficult decisions concerning the kind of observation required as well as the frequency and duration of observation.

The preponderance of lesions of minimal extent, so encouraging in many ways, is at the same time a source of difficulty in the diagnosis and prognosis of patients referred from surveys. Since about three-fourths of the lesions uncovered by surveys are minimal, the clinician must deal primarily with the stage of the disease about which knowledge is least secure. Minimal tuberculosis is notoriously covert and the problems associated with it have received less scrutiny than those of more advanced disease. The frequency with which shadows visible on X-rays are associated with a positive tuberculin reaction but not with a history of tuberculosis suggests that a large proportion of minimal lesions must heal spontaneously. Clinical axioms and prognostic criteria established largely through experience with more advanced disease, then, may not be wholly applicable to the diagnosis and management of patients with minimal disease.

There is today much controversy about the desirability of hospitalizing the patient with minimal involvement. Some take what would appear to be the more cautious course and hospitalize every patient with active minimal disease for whom a bed can be found, while others hospitalize such patients only rarely. Since it may be just as hazardous to hospitalize a patient who would be better off at home as to fail to send to the hospital one who would benefit greatly by such

a move, the question is not academic. Furthermore, in view of the serious shortage of beds in many parts of the country, a conclusive answer to this question, although difficult to achieve, is greatly to be desired.

These problems are familiar to all who conduct surveys and to many practitioners throughout the country to whom the discovered patients are referred. Re-emphasis seems justified, however, as a first step in attempting to obtain maximal effectiveness of survey procedures. While it would be naive to suggest that foolproof criteria for selection and disposition of patients will ever be attained, the magnitude and complexity of the problems brought forth by surveys demand a search for any common denominators that might be used with confidence. It seems likely that a rational basis for dealing with any patients with previously unsuspected disease—in this instance survey-discovered patients—can be provided only by careful study of the natural course of the disease in such patients themselves.

For this reason, the Division of Chronic Disease and Tuberculosis, Public Health Service, early in the development of its case-finding efforts, established a clinical research facility for long-term observation of survey-discovered patients. This project, which is the subject of this report, was considered to be one phase of a broad research program for the evaluation of mass surveys as an instrument of tuberculosis control. Another phase of the program is the facility for epidemiological studies established in Muscogee County, Ga., where the significance of survey-discovered cases is being evaluated in relation to all tuberculous patients in an entire community. The third phase of study focuses on the problems of X-ray interpretation, in an attempt to improve the usefulness of this basic tool in the discovery, diagnosis, and management of individuals with pulmonary tuberculosis.

The program for systematic investigation of the course of the disease in survey-discovered patients was established at the Temple University School of Medicine in 1946 as the "Central Cooperative Clinic for study of follow-up methods in the control of tuberculosis." The study was developed and has been conducted with the active participation of five agencies: The Tuberculosis Divisions of the U. S. Public Health Service, the Pennsylvania Department of Health, and the Philadelphia Department of Health; the Temple University School of Medicine; and the Philadelphia Tuberculosis and Health Association.

This paper presents a description of the clinic's organization and methods. In addition it seems appropriate to discuss the special problems related to surveys which form the background to the establishment of the project. Future publications will present the findings for the group of patients at the time of initial examination and the results of follow-up observations.

Investigative Approaches

It is of interest to inquire how, in a disease as ancient as tuberculosis, we can still be faced with fundamental problems of recognition and clinical understanding of the disease. Part of the answer may lie in the difficulty of achieving a systematic observation of the entire cycle of any chronic disease. Most follow-up studies in tuberculosis have been conducted on special groups of patients. When the evaluation of therapy is the objective, only patients who warrant the therapy are observed; and when incipient disease is the central interest, only patients who were previously negative by certain criteria are included. Similarly, sanatorium and post-sanatorium groups are restricted samples. Few studies, if any, have been conducted on samples truly representative of the tuberculous population. And yet, mass surveys conducted in the general population turn up a group which might be considered representative of the nonhospitalized tuberculous population. We are now exposing unfamiliar elements of the total problem which have previously escaped attention. Consequently, it is impossible, with the scanty evidence presented by many of these patients, to interpret their disease in the light of previous experience.

Like other chronic diseases, tuberculosis is a continuous process progressing by infinitesimal degrees, from the first moment of infection through the various stages leading to recovery, chronicity, or death. The population of individuals afflicted may be visualized as occupants of a continuum, with varying numbers at each of the many stages through which the paths of the continuum progress. Understanding of the natural history of the disease depends upon knowledge of its entire span. Until now, systematic observations have been concentrated at the extremes of the continuum, where the disease is either considerably advanced or just begun. The great gap in knowledge of the nature of the disease is in the large middle range between the two extremes. Here are the latent and asymptomatic lesions and the apparently stable scars. This is the part of the continuum of tuberculosis which is newly brought into the open by mass X-ray surveys, and many of the problems related to surveys can be traced to our meager understanding of this large segment.

Ideally, a comprehensive study of the entire cycle of tuberculosis would be longitudinal in approach. It would require the systematic observation and periodic tuberculin testing of a very large sample of normal individuals to identify infected persons promptly. These individuals would then be followed intensively from incipience through the entire course of the disease to full recovery or death. However, for a disease with the incidence of tuberculosis, the size of the sample required makes this approach extremely complicated and prohibitively expensive.

A second approach is cross-sectional, whereby an apparently healthy population is examined to detect all persons in it who have evidence of the disease at a single point in time. This provides a profile of the disease in all stages of development. It is a very useful picture of the range of the disease, but for elucidation of the natural history is limited in providing only a static instead of a dynamic portrayal. The patterns of movement of patients (in the continuum) from one phase of disease to another are not revealed by this approach.

The program of the Central Cooperative Clinic combines the two approaches in an attempt to realize the advantages of each. As a short cut to the more elaborate longitudinal study, initial screening by mass X-ray survey provides a starting point from which a longitudinal study of a more restricted population may proceed. Intensive follow-up of all the individuals identified in the survey supplies a dynamic portrayal of the disease. This applies primarily to the middle range of the continuum, however, since the two end-points are largely missed. Part of the cycle is not far enough advanced to show evidence on the X-ray and another portion is so advanced that the individuals in it cannot be expected to be found in true proportion among apparently healthy people. This limitation is not considered serious, since our knowledge of the two extremes is better documented than is our knowledge of the middle portion of the continuum.

In many respects these considerations may not be limited to tuberculosis but might apply to other chronic illnesses as well. The public health and clinical problems of defining what constitutes significant deviations from normal may be similar in tuberculosis and other diseases. It seems logical to assume that, as in tuberculosis, solution of these problems will require an understanding of the nature and course of the entire spectrum of the disease. It appears likely that this understanding will be achieved no more easily for other diseases, but only through long-range systematic observations of representative groups of individuals. Investigative approaches used in the study of tuberculosis may be a valuable guide.

The Central Cooperative Clinic

The fundamental problems posed by mass survey activities may be expected to yield only to a multiple attack from many angles. The Central Cooperative Clinic is an attempt to perform one essential part of the research required. Its purpose is the systematic, long-range, and continuous observation of a complete yield of patients from a number of routine surveys to determine the ultimate clinical outcome for such patients.

Ideally, such observations should be detached, without interference by the observer with the natural course of the disease. This, however, can never be fully realized in observations on human beings; for not

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only does the observation itself affect the course, but active interference is necessary when indications for treatment become evident. Nevertheless, a fairly reliable portrayal of the course of the disease may be obtained if the investigation embraces as many persons with X-ray evidence of disease in a given survey population as possible, and if almost all such persons are followed with equal intensity. These basic principles guide the conduct of the Central Cooperative Clinic study.

The group of patients is unselected in the sense that no lesion that could conceivably be tuberculous was presumed to be unworthy of further observation. All of the survey films were interpreted independently by at least two readers, and any individual whose film was considered by either of the readers, to show evidence characteristic or suspicious of tuberculosis, was included for further study. The patients admitted to the clinic were all given the same type of intensive initial examination and then carried on a schedule of periodic observation.

The special efforts that are required to retain cooperation of the group are reflected in the composition of the clinic staff. Permanent full-time members include two physicians, three public health nurses, two medical social workers, two laboratory technicians, a radiology technician, a biostatistician, three statistical clerks, and four stenographers. In addition, there is a weekly medical conference with three permanent consultants: a radiologist and two specialists in chest diseases, one of whom is Director of Surveys.

The 643 patients who comprise the case load were identified from among 15,245 persons X-rayed in 17 surveys conducted in Philadelphia during the years 1946 and 1947. Three government agencies, 1 neighborhood community, and 13 private industrial establishments were included. All of the surveys were conducted by the Philadelphia Tuberculosis and Health Association as part of its routine case-finding program.

Persons whose 70-mm. films were classified as "T" (tuberculosis) by one or both readers were called in for a consultation with the Director of Surveys at the Philadelphia Tuberculosis and Health Association who discussed the need for further evaluation with each individual. The director called the family physician by telephone in the presence of the patient and made known the nature of the findings and the purposes of the suggested follow-up at the clinic. A large majority of individuals interviewed in this way accepted appointments for visits to the clinic, and only rarely did a physician fail to consent to the proposed observation. At the end of each interview, a 14″ x 17″ X-ray of the chest was obtained.

When the 70-mm. film was called "S" (suspicious) by one or both readers, the individual was recalled for 14″ x 17″ reexamination. If this film was read as "T," the individual was admitted by the pro-

cedure described above. It was the policy to have films designated "N" (negative), "S," or "O" (nontuberculous disease) reviewed by the three members of the consultant conference. In practice, when all three consultants could not review a film, it was reviewed by at least one of them. If the film showed evidence of tuberculosis, the individual was admitted to the clinic after an orienting interview as described above.

Persons who failed to keep appointments were sent two form letters 1 month apart urging them to report. When these measures failed, the social workers and nurses made intensive efforts to obtain cooperation. In certain instances, patients with known disease already under supervision in other clinics chose not to transfer to the Central Cooperative Clinic for follow-up. Attempts were made to obtain periodic medical reports and films on these patients. When patients moved out of town after admission to the study, the follow-up was continued through the cooperation of official and voluntary health agencies in the new place of residence.

During the initial visit to the clinic each patient was given a complete physical examination and medical, social, occupational, and contact histories were elicited. Specimens were obtained for complete blood count, sedimentation rate, serologic tests for syphilis, and urinalysis. Each patient was skin-tested with tuberculin and histoplasmin, by the intradermal method using 0.0001 mg. PPD and 0.1 cc. 1:1000 histoplasmin. Routine roentgenographic studies on 14″ x 17″ film consisted of a single posterior-anterior projection and a posterior-anterior stereoscopic pair taken after repositioning of the patient. Specimen bottles were given to each patient with instructions for collection of sputum, and an appointment was made for a return visit in 48 hours to allow reading of the skin test reactions and for obtaining gastric washing specimens for bacteriological study.

Early in the study an attempt was made to obtain gastric washings examinations on all of the patients. It soon became obvious, however, that a considerable number would fail to return if this type of examination were required without exception. For this reason, the policy was modified and "gastrics" were reserved for the more amenable patients, unless a suspicion of activity warranted special efforts to obtain the examination in any particular case.

At the time of the 48-hour visit, the patient was again interviewed by the physician who demonstrated the films and interpreted the results of examinations carried out on the previous visit. After the skin test reactions were inspected, special radiographic studies were performed (apical lordotics, laterals, planigrams, etc.) if they were indicated from the review of the routine films. Sputum specimens were examined by smear and by inoculation of two tubes each of Petragnani's and Loewenstein's media. Positive cultures were

routinely confirmed by differential subculture at room temperature and at 37° C., and, in addition, by intraperitoneal inoculation of guinea pigs.

At the end of the 48-hour visit the patient was instructed to call the clinic physician at an appropriate time for a report of the conference diagnosis and recommendations. Specimen bottles were again given to the patient with instructions for their use at the time of the next visit, for which an appointment was made by mail.

At the first weekly meeting of the consultant conference following these visits, the clinical data and films of each case were reviewed. A working diagnosis was reached, and decisions were made as to interval of reexamination, special studies, and referral for treatment when indicated.

The usual interval for reexamination was 3 months, with a 6-week schedule for patients with more dubious status. At each follow-up visit an interval history was elicited by the physician, and roentgenographic and bacteriological examinations similar to those of the initial visit were performed. In many cases, additional sputum specimens were mailed in by the patients between visits.

In the beginning, the conference reviewed each set of additional films and other data on all of the patients, but as the case load and the number of serial films increased, it became necessary for the clinic physicians to screen the films and other data in order to select the more questionable cases for conference consideration. Although it was not feasible for the conference to review each case following each visit, an attempt was made to have a conference review of all cases periodically.

Patients were informed of their negative status only when the conference had unanimously agreed on two successive examinations that no tuberculosis was present. These patients were not discharged from the study, but were asked to return for annual "checkup" films. Appointment letters were sent for the annual follow-up.

It was clearly understood that the success of a long-range follow-up program would hinge upon the ability of the clinic to keep its case load; and in the day-to-day conduct of the clinic much attention was given to maintaining personal and enduring relationships with the patients. The clinic started at a disadvantage because of the unpleasant connotations of a "free clinic" in the minds of some patients. Much effort was expended to eliminate this prejudice, and every known source of inconvenience to the patient was avoided. Patients were seen at their convenience by appointment. This obviated any prolonged "bench-sitting" and loss of time, but was achieved at the cost of a very elaborate scheduling procedure. The patient's working hours and place of employment, his stated preference for visiting hours, the type of examination to be performed, and the advantages of hav-

ing certain favored personnel present were only some of the factors to be considered in fixing an appointment for each visit. And even then, a return postcard was enclosed in each appointment letter to allow the patient to suggest a more convenient hour. Although arrangements were made whenever possible through the medical departments of industrial plants to allow compensated time off for workers to visit the clinic, some sessions in the evenings, on Saturdays, and on holidays had to be arranged. The case of each ex-serviceman was investigated thoroughly by the medical social workers to determine possible service-connection and compensable disability. For those patients requiring treatment, local resources of all official and voluntary agencies were thoroughly exploited.

Throughout the period of study, each family physician was kept acquainted with the findings by periodic reports, and no major decisions were made without prior consultation. The clinic limited its activities to diagnostic examinations, and patients requiring therapy were referred to their physicians or appropriate agencies.

The extensive discussion of these details is warranted by the fact that these measures and attitudes became an essential part of the endeavor. It became evident that patients respond best in an informal atmosphere, provided dignity is preserved and no confidence is breached. The attainment of rapport and such an atmosphere in a follow-up clinic cannot be accomplished with ease. Indeed, success seems unlikely in any extended follow-up program on individuals with free choice unless continuous attention is given to this fact. Despite all of our best efforts, the problem of delinquency has not been negligible. Future reports will give further discussion to this problem, which also has implications for many diseases besides tuberculosis.

Of course, there remains the problem of patients who failed to appear initially. And yet, to preserve the validity of the results, it is essential to know what happened to those who should have been but were not observed. Although major emphasis to date has been placed upon the case load, further information will be sought for those read positive in the survey but never studied. A careful record of all those individuals has been preserved to make such studies possible. It is not expected that detailed information will be accessible on individuals who were uncooperative from the outset, but, at the very least, knowledge of the incidence of reported tuberculosis morbidity and mortality in this group can be ascertained, and it should be possible to learn what members of the group are alive and working. Information on disease and death will be gathered by checking the vital statistics files of the Philadelphia Department of Health. Knowledge of the current status of the living will require canvassing by letter, telephone, and home visit. Useful data on this group are also

to be expected from the resurvey of the original 17 establishments which is under way.

Summary

With increasing frequency, physicians throughout the country are being confronted with the problems presented by individuals found in surveys to have lesions. The proper disposition of these patients is important to the success of the survey program, but it is frequently difficult to achieve. The lack of reliable criteria for prognosis, the paucity of documented follow-up experience with such patients, the differences in the characteristics of survey-discovered and manifest tuberculosis and the limitations of roentgenographic interpretation all contribute to the problem.

The advantages and disadvantages of longitudinal and cross-sectional approaches have been discussed in relation to investigations for the elucidation of problems posed by patients identified in surveys. A plan of study which combines both approaches has been formulated with the establishment of the Central Cooperative Clinic for the systematic and prolonged observation of survey-identified patients. The project is a cooperative research enterprise initiated and conducted by the U. S. Public Health Service, the Pennsylvania Department of Health, the Philadelphia Department of Health, the Temple University School of Medicine, and the Philadelphia Tuberculosis and Health Association. The objectives of the study have been stated and the methodology has been discussed in detail.

It has been suggested that the problems encountered in other chronic diseases may be amenable to a similar approach.

Effect of PAS on the Emergence of Tubercle Bacilli Resistant to Streptomycin

A Public Health Service Cooperative Investigation*

The effectiveness of streptomycin in the treatment of tuberculosis has one serious limitation: the ability of the tubercle bacillus to adapt itself to the presence of the antibiotic. The most promising approach to the problem of streptomycin-resistant organisms was suggested by *in vitro* studies, which showed that bacterial populations readily developed mutants in the presence of one drug or another but no doubly-resistant mutants that could grow out in the presence of two independently acting drugs. In this way a second drug might be expected to delay the emergence of organisms resistant to streptomycin.

The present paper reports the effect of para-aminosalicylic acid (PAS) on the emergence of tubercle bacilli resistant to streptomycin in cases of pulmonary tuberculosis. The results of *in vitro* streptomycin sensitivity tests on cultures of tubercle bacilli isolated from sputum specimens obtained from 103 patients who received dihydrostreptomycin and PAS therapy are compared with results from a concurrent series of 114 patients who received dihydrostreptomycin alone.

The data were obtained in a cooperative study which was a part of the program of clinical trials of streptomycin therapy in the treatment of tuberculosis initiated by the Tuberculosis Study Section of the Division of Research Grants and Fellowships of the National Institutes of Health. In this present inquiry, clinicians in 10 centers managed their patients under a common protocol, made observations in a uniform manner, and pooled them for combined analysis and presentation. Sensitivity testing was centralized in two laboratories in an effort to attain homogeneity of data by limiting the variation in testing technique. The design of the investigation provided for the chance allocation of cases selected for study to three regimens: dihydrostreptomycin alone, dihydrostreptomycin and PAS, and streptomycin and PAS. More comprehensive results of the investigation will be presented later.

*Presented at the 47th Annual Meeting of the National Tuberculosis Association, Cincinnati, Ohio, May 16, 1951, by Dr. Frederick Beck. Previous papers in the series on the evaluation of streptomycin in treatment of tuberculosis are: (1) A controlled investigation of streptomycin treatment in pulmonary tuberculosis. Pub. Health Rep. 65; 1421 (1950), and (2) Resistance to streptomycin of tubercle bacilli isolated from patients treated with streptomycin. Pub. Health Rep. 66: 277 (1951).

The study was coordinated by the Field Research Branch of the Division of Chronic Disease and Tuberculosis, Public Health Service. Statistical analysis was performed and the report prepared for the group by Miss Nancy J. Brombacher of that office. The opinions expressed in this report represent the consensus of the investigators.

The clinicians who, with their staffs, participated in the study were:

INVESTIGATOR	LOCATION
Dr. Theodore L. Badger	The Channing Home for the Tuberculous, Boston, Mass.
Dr. Frederick Beck	Ray Brook State Tuberculosis Hospital, Ray Brook, N. Y.
Dr. Francis P. Dawson	Middlesex County Sanatorium, Waltham, Mass.
Dr. Alfred Goldman	Robert Koch Memorial Hospital, Koch, Mo.
Dr. Ralph Horton	Homer Folks Tuberculosis Hospital, Oneonta, N. Y.
Dr. N. Stanley Lincoln	Hermann M. Biggs Memorial Hospital, Ithaca, N. Y.
Dr. Howard M. Payne	Freedmen's Hospital, Washington, D. C.
Dr. Rufus F. Payne	Battey State Hospital, Rome, Ga.
Dr. H. McLeod Riggins	New York, N. Y.
Dr. Arthur M. Stokes	Mount Morris Tuberculosis Hospital, Mount Morris, N. Y.
Dr. H. Stuart Willis and Dr. Lynn Johnsen.	The North Carolina Santorium, McCain, N. C.

The participating bacteriologists in the central laboratories were:

Mr. William Steenken, Jr.	The Trudeau Laboratory, Trudeau, N. Y.
Dr. Guy P. Youmans	Northwestern University Medical School, Chicago, Ill.

Materials and Methods

Patient Population

Originally 157 patients were designated to receive dihydrostreptomycin alone, and 158 to receive dihydrostreptomycin and PAS. The present analysis has been limited to observations on 114 patients who completed a 13-week course of 1 gram per day of dihydrostreptomycin, and 103 who received a similar course of dihydrostreptomycin plus 10 grams per day of PAS. Prior to treatment, positive cultures which were sensitive to streptomycin were obtained from all of these patients. None of the patients had received more than 10 grams of streptomycin or dihydrostreptomycin prior to admission to the study.

Observations

Observations were made at 10 points during a 27-week period. Specimens for culture were obtained during the week preceding the start of treatment, during treatment (in the 4th, 6th, 8th, 10th, and 12th weeks), and after treatment (in the 14th, 18th, 22d, and 27th weeks).

Isolation and Cultivation of Tubercle Bacilli. The plan of the study called for a uniform and reasonably thorough test for the presence of tubercle bacilli in sputum, to be used by all the participating sanatoria. The test was based on two specimens of sputum taken on different days of the observation week. When expectoration was copious, a morning collection of sputum was recommended; otherwise, a 24-hour sputum specimen was obtained. In the relatively rare cases where expectoration was absent, gastric washings were obtained.

In each hospital, the two specimens were planted in duplicate on tubes of whatever egg-yolk medium had been found most satisfactory. When growth in one of the four tubes was well developed, the culture was sent to a central laboratory for sensitivity testing. In general, all tubes were held at least 6 weeks before being discarded as having "no growth."

For the present analysis, a positive test was defined as any test in which growth occurred in one or more tubes, and a negative test, as one in which at least three tubes were read and all showed no growth. Since some tubes were missing or contaminated, tests in which less than three tubes were available, with no growth present in the available tubes, were classified as unknown. In these tests there was too little evidence to justify a "negative" classification and no evidence of a "positive."

Sensitivity Determinations. A standard procedure was established by the laboratory investigators for the uniform performance of sensitivity tests. From the primary cultures received from the sanatoria, subcultures were made in Tween-albumin liquid medium. When the Tween-albumin subcultures were 7–10 days old and had reached a fairly heavy and uniform density, the flasks were shaken vigorously to produce an even suspension for use as a source of inocula.

In view of the chemical similarity between streptomycin and dihydrostreptomycin, the laboratories used streptomycin in the test media to assay dihydrostreptomycin resistance. Streptomycin in final concentrations of 100, 10, and 3 micrograms per milliliter was added to 3 tubes of Herrold's egg-yolk agar; a fourth tube containing no streptomycin was used as a control. Tests were read at 14, 21, 28, and 35 days after inoculation from the Tween-albumin subculture. The amount of growth in each culture tube was estimated on a 1+ to 4+ scale.

Specimens from patients who received the two-drug regimen were

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also tested for PAS sensitivity. The concentrations of PAS in the three drug-containing tubes were 0.1, 1 and 10 mg. percent. In the present study, resistance to PAS occurred in only one culture.

The level of sensitivity to streptomycin has been defined as the highest concentration of streptomycin (mcg./ml.) in which growth of 20 colonies or more occurred at any of the four reading times. The definition is subject to two conditions: (1) that growth in the control tube was 3+ or 4+, and (2) that growth in streptomycin did not exceed growth in the control. If those conditions were not met, the result was considered "unknown." Three levels of sensitivity were distinguished: resistant to 100 mcg., resistant to 10 mcg., and sensitive.

Completeness of Observations. Since 9 tests for bacteriological status after the initiation of therapy were specified, a total of 1,953 tests would be expected on the 217 patients forming the case material for the study. However, a complete series of observations could not be obtained on every patient. Where status was clearly indicated by tests given before and after a missing observation in a series, estimates were made. A total of 104 observations, or 5 percent, were neither obtained nor estimated.

Missing observations appeared to have a random distribution. Concentrations of four or more missing tests in the series for a single patient occurred in only 3 percent of the dihydrostreptomycin group, and 2 percent of the dihydrostreptomycin-PAS group. Since these percentages were relatively low, no cases were excluded on the basis of missing information on bacteriologic status, and the data have been included at the observation points at which they are available.

Results

In the course of the pretreatment tests, an unexpected result, which requires further study before its significance can be properly evaluated, was obtained. For 46 patients (20 in the dihydrostreptomycin group, and 26 in the dihydrostreptomycin-PAS group) streptomycin-resistant organisms were identified in cultures of pretreatment specimens. None of these 46 patients was reported to have received either streptomycin or dihydrostreptomycin previously.

Examination of subsequent tests, however, casts doubt on the validity of the pretreatment observation for seven patients. The nine subsequent observations for these patients showed no further indication of resistance. For the remaining 39 patients, subsequent test results can neither confirm nor refute the initial finding, since any resistance appearing in tests after the initiation of treatment may have been due to the effect of the prescribed course of dihydrostreptomycin.

Only a moderate level of bacterial resistance to the drug was reported for the majority of these patients. Forty yielded cultures resistant to 10 micrograms of drug and only 6 to 100 micrograms. The rate of growth was not rapid for a number of the pretreatment cultures. Resistance was first reported on the 14th day for 16 of these pretreatment cultures, on the 21st day for 16, on the 28th day for 11, and on the 35th day for 3.

The possibility exists that information on previous drug therapy was incompletely or incorrectly reported to the hospitals and that a substantial proportion of this group actually had streptomycin or dihydrostreptomycin prior to the study. A careful investigation of all the factors involved is now under way. Results on these cases have been excluded from the major analysis.

Course During Observation

The most elementary basis for evaluating the effect of PAS in the emergence of streptomycin resistance is to compare the status of the patients in the dihydrostreptomycin group with that of the patients in the dihydrostreptomycin-PAS group at each of the 10 observation points. The second paper in this series emphasized that the significance of bacterial resistance depends not only on the frequency of its occurrence in positive cultures, but also upon the frequency with which the positive cultures themselves occur in a population. This is particularly true in a comparison of two regimens in which the differential effect of chemotherapy may not be limited to the development of resistance. The interrelationship between the bacteriological and resistance findings was taken into account in establishing the axis of classification of the groups. The distributions of the groups by categories at each of the observation points afford a basis for comparison of the course of the dihydrostreptomycin group over the 27 weeks with the similar course of the dihydrostreptomycin-PAS group. The actual distributions, which include the numbers of "unknowns" as well as the numbers in the five known categories, are given in the appendix table. Percentage distributions based on the total known observations are given in table 1 and figure 1.

It is apparent that, for both drug groups, the major movements occurred almost entirely during the 13-week period of drug administration. By the 14th week of observation, both groups were distributed by categories into proportions which remained fairly stable throughout the remainder of the 27 weeks.

While the nature of the changes for the two groups was similar in that they occurred for the most part during the treatment period, distinct differences in the composition of the two groups throughout the 27 weeks are apparent. Tubercle bacilli were not cultured from the sputa of a higher proportion of patients in the dihydrostreptomycin-

Table 1. *Percentage distributions of groups of 114 dihydrostreptomycin and 103 dihydrostreptomycin-PAS patients by bacteriological status and streptomycin resistance status at 10 points of time*

Status	Observation week from beginning of therapy									
	Pre-treatment	4	6	8	10	12	14	18	22	27
DHSM Group										
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100 0	100.0	100.0
Negative cultures	0	8.0	18.7	24.3	32 7	33.3	37 3	37.9	38.5	36.3
Positive culture	100.0	92 0	81.3	74.8	66.4	65.8	61.8	59.3	57.7	57.8
Sensitive	100.0	71.4	47.7	34.6	23.4	16.2	10 9	15 7	10.6	14.7
Resistant to 10 mcg	0	18.8	23.3	24.3	26.2	28.0	30.9	26.9	24.0	23.5
Resistant to 100 mcg	0	1.8	10.3	15.9	16.8	21.6	20.0	16.7	23.1	19.6
Patient dead	0	0	0	.9	.9	.9	.9	2.8	3.8	5.9
DHSM-PAS Group										
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Negative cultures	0	11.0	30.3	37.5	47.5	55.6	52.4	54.1	48.9	46.3
Positive culture	100.0	88.0	67.7	60.4	50.5	42.4	45.6	43.9	48.9	51.6
Sensitive	100.0	82.0	60.6	57.3	43.4	36.4	36 6	36 7	37.2	40.0
Resistant to 10 mcg	0	3.0	6.1	2.1	4.1	2.0	5.0	4.1	8.5	8.4
Resistant to 100 mcg	0	3.0	1.0	1.0	3.0	4.0	4.0	3.1	3 2	3.2
Patient dead	0	1.0	2.0	2.1	2.0	2.0	2.0	2.0	2.2	2.1

PAS group. Markedly lower proportions of patients with positive cultures resistant to streptomycin are noted for the combined-drug group than for the single-drug group. For the former the proportion of those with sensitive cultures was higher than for the latter. In the two groups, however, the proportion of deaths does not differ appreciably.

At 14 weeks, 52 percent of the combined-drug group had negative cultures as against 37 percent in the single-drug group. The frequency of occurrence of resistant cultures shows an even greater contrast. The total proportion of patients whose cultures were resistant to at least 10 mcg. was 9 percent for the dihydrostreptomycin-PAS group (less than one-fifth of the 51 percent reported for the dihydrostreptomycin group). The proportions with sensitive bacilli were 37 percent for the combined-drug group and 11 percent for the single-drug group. Deaths were 2 and 1 percent, respectively.

Highest Level of Resistance During Treatment

The two groups may also be compared in a somewhat different way. Since the proportion of patients with negative cultures increased rapidly during the period of drug therapy in both groups, but more rapidly in the two-drug group, the proportions with negative cultures at 14 weeks include patients who may have developed resistance earlier. A truer picture of the incidence of resistance may be obtained by comparing the proportions of the groups in whose cultures resistance appeared at any time during the treatment period.

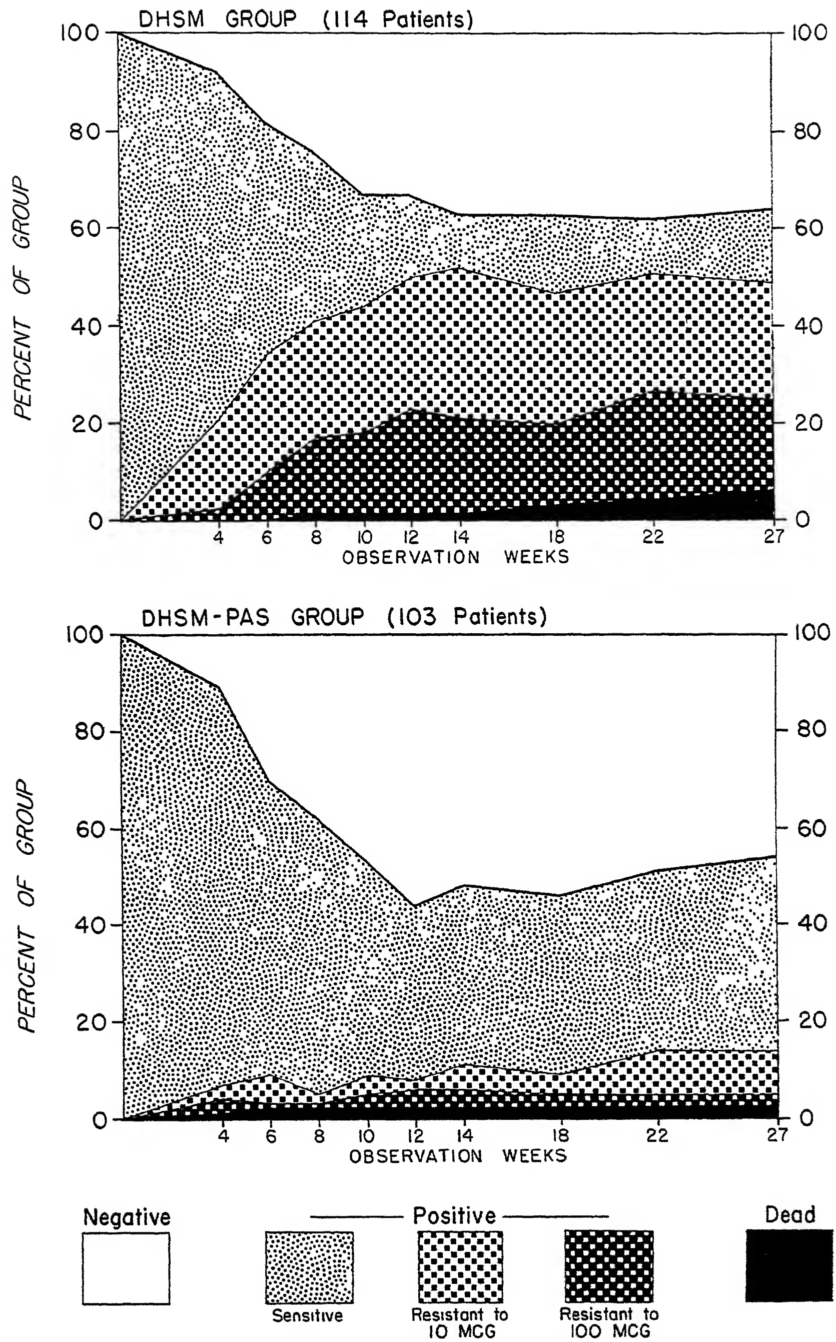


Figure 1. Percentage distribution of dihydrostreptomycin and dihydrostreptomycin-PAS groups by bacteriological status and streptomycin resistance status, at 10 points of time.

Table 2. *Distributions of dihydrostreptomycin and dihydrostreptomycin-PAS groups by highest level of resistance found in cultures from specimens obtained between the 4th and 14th weeks of observation*

Highest level of resistance reported	DHSM Group		DHSM-PAS Group	
	Number	Percent	Number	Percent
Total	114	100.0	103	100.0
100 mcg.	34	29.8	8	7.8
10 mcg.	41	36.0	13	12.6
None	39	34.2	82	79.6

In table 2 and figure 2, the categories "resistant to 10 mcg." and "resistant to 100 mcg." represent the highest level of resistance found for patients for whom at least one resistant culture was reported for any of the six observation points between the 4th and 14th weeks, inclusive. On this basis, cultures resistant to 100 mcg. were reported for 30 percent of the dihydrostreptomycin group and only 8 percent of the dihydrostreptomycin-PAS group. The total proportions of the groups whose cultures were resistant to at least 10 mcg. (the sum of the two categories) were 66 percent and 21 percent, respectively. Thus, resistance was noted at some time during drug administration in the cultures of about one-third as many combined-drug patients as for single-drug patients.

Relation to Type of Case

An attempt has been made to determine whether the capacity of PAS to decrease the frequency of streptomycin-resistant cultures is associated with a particular type of case. For this purpose, sensitivity test results of this investigation have been correlated with certain X-ray and clinical observations which reflect the status of the patients at the beginning of observation. The method of X-ray evaluation and of analysis of the X-ray data differed only in detail from that fully described in the first paper of this series.

The patients in the two groups were classified on the basis of their initial characteristics with respect to stage and course of disease, predominant morphology, dynamics of the tuberculous process, presence of cavitation, and body temperature. The frequency with which resistant cultures appeared during the period of drug therapy in each of the subgroups thus obtained was compared.

Since the size of the individual groups is, in some instances, so small that chance variations may be very large, detailed results are not presented here. However, while resistance consistently appeared less frequently in the cultures of patients in the combined-drug group, the characteristics of those patients in each group whose cultures did develop resistance were similar. Thus, it may be that the action of PAS in the suppression of bacilli resistant to streptomycin is not selective as to type of case.

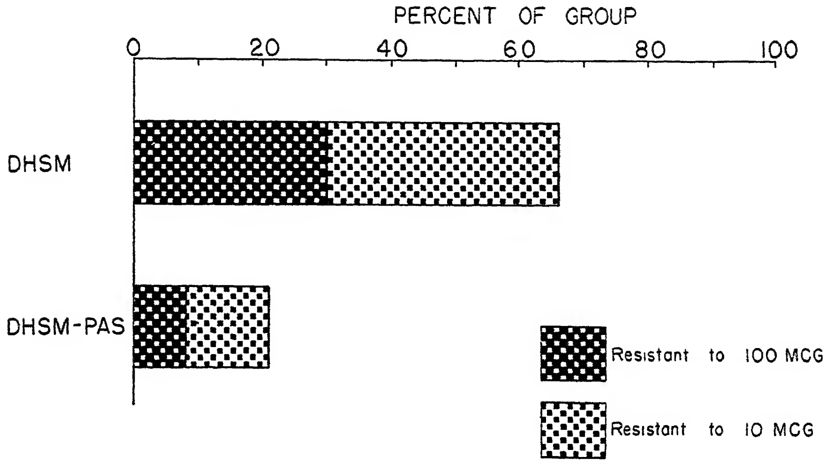


Figure 2. Percentages of dihydrostreptomycin and dihydrostreptomycin-PAS groups producing cultures resistant to 100 mcg. of streptomycin and to 10 mcg. at least once between the 4th and 14th week of observation.

Certain interesting patterns common to both groups appeared. Resistance was more often associated with far advanced disease than with moderately advanced disease; with cavitary disease more frequently than with non-cavitary; with progressive rather than stationary or retrogressive processes; and among the febrile more often than among the afebrile. When the cases were classified by predominant morphology (exudative, caseous, fibrotic) or by dynamics (acute, subacute, chronic), no meaningful differences in the incidence of resistant cultures were apparent. This failure to discern differences may well reflect the limitations of classification, rather than the absence of relationship. The greater frequency of resistant bacilli in the cultures derived from febrile patients, or those with far advanced, with cavitary, or with progressive disease may be simply a reflection of the greater frequency with which bacilli, resistant or sensitive, are found in these subgroups. Further investigation of these relationships is planned through the combination of several studies in this series.

Summary

The design of a cooperative investigation sponsored by the Public Health Service provided for the chance allocation of pulmonary tuberculosis patients to three regimens: dihydrostreptomycin alone, dihydrostreptomycin and PAS, and streptomycin and PAS. As a part of the study, sputum specimens were obtained at 10 points in a 27-week period from patients located in 10 participating institutions. Tests for the presence of tubercle bacilli were performed by the institutions. Resulting positive cultures were tested by central laboratories for sensitivity of the bacilli to the chemotherapeutic agents.

The effect of PAS on the emergence of tubercle bacilli resistant to streptomycin has been studied in 114 patients receiving dihydrostreptomycin and 103 patients receiving dihydrostreptomycin and PAS. The patients received drug therapy for 13 weeks, and were observed for a total of 27 weeks. All of the patients received 1 gram of dihydrostreptomycin daily, while one group received, in addition, 10 grams of PAS daily.

The results show that:

1. In both groups, the major changes in bacteriological status occurred during the period of drug administration, with only minor shifts thereafter.

2. At the 14th week, the first observation point after the end of drug therapy: (a) Tubercle bacilli were not cultured from the sputa of 37 percent of the dihydrostreptomycin group and from 52 percent of the dihydrostreptomycin-PAS group. (b) Streptomycin-resistant organisms were found in the cultures from 51 percent of the dihydrostreptomycin patients and only 9 percent of the dihydrostreptomycin-PAS patients.

3. The action of PAS in suppressing the emergence of streptomycin-resistant bacilli does not appear to be confined to any particular type of case.

4. The significance of the identification of resistant organisms in pretreatment cultures from 46 patients is obscure and poses a problem for further investigation.

Appendix table. *Distributions of groups of 114 dihydrostreptomycin and 103 dihydrostreptomycin-PAS patients by bacteriological status and streptomycin resistance status at 10 points of time*

Status	Observation week from beginning of therapy									
	Pre-treatment	4	6	8	10	12	14	18	22	27
DHSM Group										
Total	114	114	114	114	114	114	114	114	114	114
Negative cultures	0	9	20	26	35	37	41	41	40	37
Positive culture	114	103	87	80	71	73	68	64	60	59
Sensitive	114	80	51	37	25	18	12	17	11	15
Resistant to 10 mcg	0	21	25	26	28	31	34	29	25	24
Resistant to 100 mcg	0	2	11	17	18	24	22	18	24	20
Patient dead	0	0	0	1	1	1	1	3	4	6
Unknown	0	2	7	7	7	3	4	6	10	12
DHSM-PAS Group										
Total	103	103	10[illegible]	103	103	103	103	103	103	103
Negative cultures	0	11	30	36	47	55	53	53	46	44
Positive culture	103	88	67	58	50	42	46	43	46	49
Sensitive	103	82	60	55	43	36	37	36	35	38
Resistant to 10 mcg	0	3	6	2	4	2	5	4	8	8
Resistant to 100 mcg	0	3	1	1	3	4	4	3	3	3
Patient dead	0	1	2	2	2	2	2	2	2	2
Unknown	0	3	4	7	4	4	2	5	9	8

BCG Vaccination in Poland

This second [1] in the series of Tuberculosis Research Office publications concerned with BCG vaccination programs throughout the world appears to be as valuable a report as its predecessor.[2] Excellently illustrated by charts and maps, it documents the immense amount of material gathered in Poland during the largest single campaign in any individual country that has yet participated in the international BCG campaign. It is based on statistical data collected by Polish and Scandinavian teams in the course of their field work and follows closely the pattern set by TRO's first report on the Czechoslovakian campaign.

Like the latter, it is divided into four main sections, dealing first with the organization and performance of the campaign, second with the variability, completeness, and reliability of the material, third with results of statistical tabulation and analysis, and last with charts giving basic statistics on tuberculin testing and BCG vaccination. This mass testing and vaccination was accomplished in war-devastated Poland in 1948–49 through the collaboration of the Polish Ministry of Health and Joint Enterprise, the organization created by the United Nations International Children's Emergency Fund, and three Scandinavian voluntary groups (later known as the International Tuberculosis Campaign).

The program proper was preceded by work performed from May 1947 to June 1948 under the auspices of the Danish Red Cross which indicated an unusually high prevalence of tuberculosis infection and disease in Poland and confirmed the seriousness of tuberculosis as a national health problem. Material forming the basis of statistical reports includes data on the testing of 4,703,561 and the vaccination of 2,263,952 persons. Over 93 percent of the individuals tuberculin tested completed their tests. Of these, 52 percent were tuberculin negative, and 99.5 percent of the negative reactors were vaccinated.

Details of organization and administration will be of interest wherever similar programs are contemplated. Field work, directed from headquarters in Warsaw, was conducted through each of 14 provincial and 2 municipal stations under the leadership of first a

[1] A review of Mass BCG Vaccination in Poland, 1948–1949, with Special Reference to Statistics on Tuberculin Testing and BCG Vaccination, prepared by the Tuberculosis Research Office, World Health Organization, Copenhagen and published by the International Tuberculosis Campaign, December, 1950. Copies may be obtained from International Tuberculosis Campaign, Svanemollevej 25, Copenhagen, Denmark.

[2] Mass BCG Vaccination in Czechoslovakia 1948–1949, prepared by the Tuberculosis Research Office, World Health Organization, Copenhagen and published by the International Tuberculosis Campaign, August 1950. Reviewed in PUBLIC HEALTH REPORTS 66: 444 (1951).

Scandinavian physician and later his Polish colleague. This station leader, aided by a secretary, supervised the work of three vaccination teams, each consisting of two to four vaccinators, two clerks, and a driver with a car. In each locality, actual work was preceded by wide publicity as well as meetings with health, welfare, school and political leaders, designed to promote popular understanding and support. At the height of the campaign, more than 400,000 persons were tested in a month, and half as many vaccinated. On the average each team could visit between four and five places and examine between 2,000 and 3,000 children daily.

The report states that "Information from responsible observers gave the impression that the statistical work in the field was good and records and statistics were reasonably accurate and complete . . . There were very few significant errors and defects." There are a great number of statistics, presenting all the essential information on the campaign, including tabulations of participation, tuberculin sensitivity and vaccinations, by age, sex, and detailed geographic subdivision. The Moro patch and Mantoux tests were employed for selection of individuals to be vaccinated and tuberculin sensitivity was found to be on the average unusually high in the Polish population. Positive reactors totaled 8 percent at age 1; 21 percent at age 5; 42 percent at age 10; 67 percent at age 15, and about 90 percent at age 20. The prevalence of positive tuberculin reactions among females was slightly higher than among males, and, as might be expected, considerably higher in urban than in rural areas, particularly among young adult groups. Tuberculin sensitivity, then, was on the whole higher than that reported from Czechoslovakia, where it was 3.8 percent at 1 year; 11 percent at 5 years; 26 percent at 10 years; 48 percent at 15 years, and 75.2 percent in the 20–24 year age group. In Czechoslovakia, also, there was little difference in sensitivity for urban and rural groups.

The lack of detailed population statistics for Poland made it impossible to determine the extent and completeness of testing and vaccination. TRO estimates, however, that 60 percent of the children and young adults from 1 to 18 years of age and between 80 and 90 percent of the school age groups of 6 to 14 years were actually reached. In any event, Mass Vaccination in Poland constitutes another useful permanent record from either a national or international point of view. For those who, in contemplated future studies, attempt to assay the protective value of BCG vaccination in Poland, it will be an indispensable guide.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended June 16, 1951

Poliomyelitis

For the current week 162 cases of poliomyelitis were reported, which is about 12 percent more than the 143 cases reported for the previous week. There is a correction in last week's total from 171 to 143, since only 3 instead of 31 cases were reported in Oklahoma. For the current week the States reporting 5 or more cases were as follows, the figures for last week being shown in parentheses: Texas 41 (34), California 20 (19), New York 12 (15), Oklahoma 9 (3), Louisiana 9 (7), Alabama 7 (5), Florida 7 (4), Colorado 6 (2), Georgia 6 (1), Oregon 5 (2), Iowa 5 (0), and Wisconsin 5 (1).

In Texas nearly two-thirds of the cases in the past month have been concentrated in two counties—Harris and Nueces—which have a combined population of about 1 million. Available reports do not indicate any concentration of cases in California. More than half of the cases in New York State have been reported in New York City.

The total number of cases for the United States for the current week (162) compares favorably with that for the same week last year (236). The cumulative total since the seasonal low week is 1,069 as compared with 1,323 for the same period last year.

Hansen's Disease

The San Francisco Health Department has reported a case of Hansen's disease in a 12-year-old girl who came from the Philippines with her parents 2 years ago.

Epidemiological Reports

Gastroenteritis

Dr. R. H. Hutcheson, Tennessee Commissioner of Health, has reported an outbreak of food poisoning in a family of 10 persons residing in McNairy County. All members of the family except a nursing infant became ill suddenly with headache, nausea, vomiting, and

diarrhea from 2 to 5 hours after a noonday meal on June 3. Food consisted of fried canned mackerel, home-made biscuits, hot cocoa, and a drink made from powdered fruit mixture. The canned mackerel, which was opened, cooked, and eaten within 30 minutes, was suspected of being the vehicle of infection, but this has not been proved.

Dr. J. C. Hart, Connecticut Department of Health, has reported two outbreaks of gastroenteritis in a private school, occurring 6 days apart. Both followed turkey dinners. In the first outbreak, about 65 in a population of 135 were known to be ill, and 70 were affected in the second. The incubation periods varied from 10 to 24 hours, with the majority between 10 and 16 hours. In both instances abdominal pain and diarrhea were the main symptoms, with recovery in 24 to 48 hours. Specimens of turkey and stool cultures of food handlers are undergoing bacteriological examination.

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	June 16, 1951	June 17, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	1			(1)	(1)	(1)	(1)	39	19	25
Diphtheria (055)	51	80	118	27th	4,778	7,237	10,687	1,871	2,966	4,330
Encephalitis, acute infectious (082)	8	22	11	(1)	(1)	(1)	(1)	402	317	212
Influenza (480–483)	509	326	326	30th	128,706	147,888	147,888	114,164	137,304	127,040
Measles (085)	14,312	12,802	14,073	35th	444,772	266,501	524,160	416,071	247,372	489,214
Meningitis, meningococcal (057.0)	63	75	61	37th	3,290	3,048	2,975	2,329	2,134	2,003
Pneumonia (490–493)	701	975	(2)	(1)	(1)	(1)	(1)	[3] 40,895	53,220	(2)
Poliomyelitis, acute (080)	162	236	236	11th	[4] 1,069	1,323	1,323	[4] 2,282	2,454	1,697
Rocky Mountain spotted fever (104)	14	28	27	(1)	(1)	(1)	(1)	94	127	132
Scarlet fever (050) [5]	1,048	729	1,263	32d	65,084	53,638	77,499	49,393	37,199	54,955
Smallpox (084)		1		35th	14	44	66	6	23	45
Tularemia (059)	8	30	28	(1)	(1)	(1)	(1)	322	476	476
Typhoid and paratyphoid fever (040, 041) [6]	43	61	82	11th	[7] 557	730	761	[7] 992	1,240	1,246
Whooping cough (056)	1,385	2,763	2,106	39th	58,314	85,779	79,018	36,732	64,263	47,752

[1] Not computed.
[2] Data not available.
[3] Additions: week ended June 9—Indiana 12 cases, West Virginia 5, Florida 7, Utah 6; week ended June 2, Tennessee 36.
[4] Deductions: Georgia, 1 case each for weeks ended June 2 and June 9. Addition: West Virginia, 1 case for week ended June 9.
[5] Including cases reported as streptococcal sore throat.
[6] Including cases reported as salmonellosis.
[7] Deductions: Arkansas, week ended March 31, 2 cases; week ended March 3, 1 case.

NOTE.—Oklahoma reported only 3 cases of poliomyelitis instead of 31 for the week ended June 9.

Reported Cases of Selected Communicable Diseases: United States, Week Ended June 16, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	51	8	509	14,312	63	701	162
New England	10		4	1,225	5	22	1
Maine	7		4	13		1	
New Hampshire				78		2	
Vermont				202			
Massachusetts	3			612	4		
Rhode Island				47		3	
Connecticut				213	1	16	1
Middle Atlantic	4	4	2	3,511	8	117	15
New York	3	2	[1] 1	1,667	4	28	12
New Jersey		2	1	1,076	1	49	1
Pennsylvania	1			768	3	40	2
East North Central	4		8	2,909	11	82	11
Ohio	2			388	4		1
Indiana	2		6	135		14	2
Illinois			1	364	4	30	2
Michigan			1	324	1	38	1
Wisconsin				1,698	2		5
West North Central	3	1	11	645	4	63	6
Minnesota	3		1	49	1	11	
Iowa				38		2	5
Missouri		1		308	2	1	
North Dakota			8	76		32	
South Dakota				9			
Nebraska				8			
Kansas			2	157	1	17	1
South Atlantic	10	2	188	1,380	12	94	18
Delaware				46			
Maryland			3	302		19	1
District of Columbia				51		4	
Virginia		1	178	500	5	48	1
West Virginia	2			196			1
North Carolina	7	1		43	4		2
South Carolina	1			17	1	1	
Georgia			7	83	1	22	6
Florida				82	1		7
East South Central	4	1	2	379	12	48	12
Kentucky	2			81	4	6	3
Tennessee	1	1		55	2		
Alabama	1			233	4	29	7
Mississippi			2	10	2	13	2
West South Central	9		94	1,165	3	172	61
Arkansas			76	173		30	2
Louisiana	1		1	13		22	9
Oklahoma			17	32	1	5	9
Texas	8			947	2	115	41
Mountain			182	648		58	12
Montana			27	71			1
Idaho				82			
Wyoming				53		3	
Colorado			86	97		27	6
New Mexico				76		4	1
Arizona			69	171		24	3
Utah				98			1
Nevada							
Pacific	7		18	2,450	8	45	26
Washington			4	302	3	2	1
Oregon	3		12	494	3	27	5
California	4		2	1,654	2	16	20
Alaska			27				
Hawaii				11			

[1] New York City only.
Anthrax: Pennsylvania, 1 case.

Reported Cases of Selected Communicable Diseases: United States, Week Ended June 16, 1951—Continued

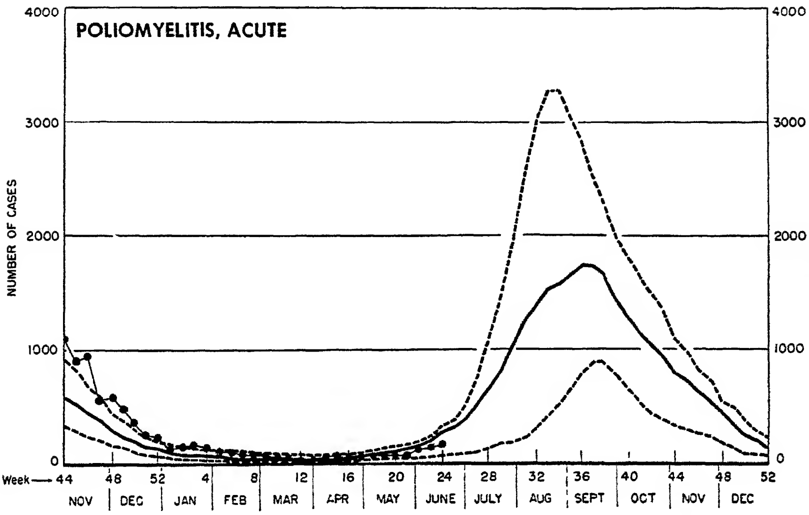
[Numbers under diseases are International List numbers, 1948 revision]

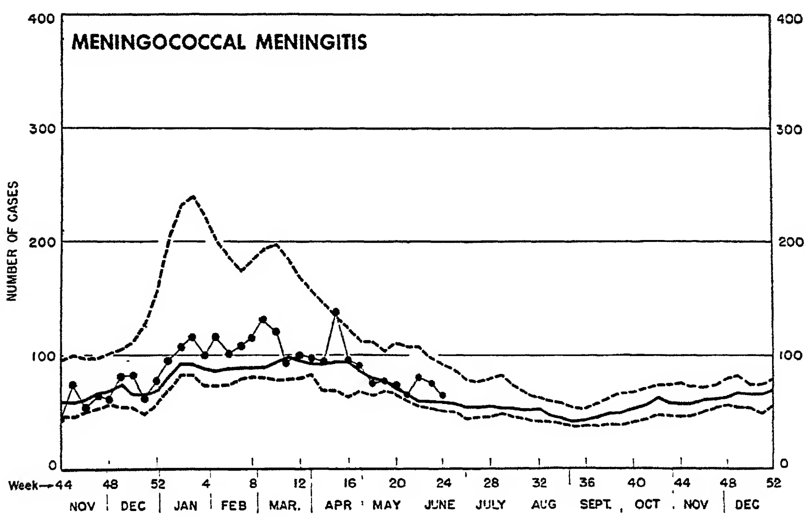
Area	Rocky Mountain spotted fever (104)	Scarlet fever (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [1] (040, 041)	Whooping cough (056)	Rabies in animals
United States	14	1,048		8	43	1,385	136
New England		107			3	42	1
Maine		16				6	1
New Hampshire		[2] 2				3	
Vermont						3	
Massachusetts		74			2	20	
Rhode Island		1				1	
Connecticut		14			1	9	
Middle Atlantic		272			6	164	6
New York		[2] 181			2	65	4
New Jersey		38			1	60	
Pennsylvania		53			3	39	2
East North Central		331			3	167	24
Ohio		88				24	5
Indiana		5			1	20	17
Illinois		33			2	19	1
Michigan		164				51	1
Wisconsin		41				53	
West North Central		39			1	69	23
Minnesota		9				6	1
Iowa		4				21	4
Missouri		15			1	9	18
North Dakota		1				3	
South Dakota		5				2	
Nebraska		1				2	
Kansas		4				26	
South Atlantic	7	77		1	3	209	18
Delaware	1						
Maryland	2	21				2	
District of Columbia		9				6	
Virginia	1	8				73	7
West Virginia		6			2		
North Carolina	2	24		1		64	
South Carolina	1	3				2	9
Georgia		2			1	13	2
Florida		[2] 4				49	
East South Central	1	28			8	94	30
Kentucky		13			4	16	7
Tennessee	1	11			2	21	11
Alabama		2			1	45	8
Mississippi		2			1	12	4
West South Central		25		5	10	473	34
Arkansas		2		4	3	76	3
Louisiana		1			3		
Oklahoma		3			1	10	3
Texas		19		1	3	387	28
Mountain	5	61		2	5	117	
Montana		5				12	
Idaho	2	25			4	14	
Wyoming				2		9	
Colorado	2	8				26	
New Mexico		1			1	12	
Arizona		5				36	
Utah	1	[2] 17				8	
Nevada							
Pacific	1	108			4	50	
Washington		13				6	
Oregon	1	3				3	
California		[2] 92			4	41	
Alaska							
Hawaii					1		

[1] Including cases reported as salmonellosis. [2] Including cases reported as streptococcal sore throat.

Communicable Disease Charts

All reporting States, November 1950 through June 16, 1951





The upper and lower broken lines represent the highest and lowest figures recorded for the corresponding weeks in the preceding 5 years. The solid line is a median figure for the preceding 5 years. All three lines have been smoothed by a 3-week moving average. The dots represent numbers of cases reported weekly, 1950–51.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases

Week ended May 26, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	1									1	
Chickenpox	989	12		27		106	556	52	17	75	144
Diphtheria	1								1		
Dysentery:											
Amebic	1						1				
Bacillary	4						3				1
Encephalitis, infectious	2						1	1			
German measles	358			4		18	205		7	45	79
Influenza	44			31	5		5	2			1
Measles	1,339	5		101	4	247	484	56	13	207	162
Meningitis, meningococcal	1						1				
Mumps	616	1		49		139	275	22	19	55	56
Poliomyelitis	1						1				
Scarlet fever	384				1	74	28	53	12	66	150
Tuberculosis (all forms)	196	18		5	5	79	40	12	7	3	27
Typhoid and paratyphoid fever	13					5			1	2	5
Venereal diseases:											
Gonorrhea	263	9		2	6	86	50	18	18	24	50
Syphilis	93	5		4	3	38	16	5	3	2	17
Primary	6					2	2			1	1
Secondary	4					1	3				
Other	83	5		4	3	35	11	5	3	1	16
Whooping cough	110	1		5	1	23	45	7	6	15	7

Week ended June 2, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	4					2	1			1	
Chickenpox	1,134	3		32		199	512	64	22	117	185
Diphtheria	4					3			1		
Dysentery, bacillary	10					1	7	2			
German measles	388	1		1		50	228		13	37	58
Influenza	41			22	1		4	9			5
Measles	1,694	4		106	1	607	453	44	5	331	143
Meningitis, meningococcal	4					1	3				
Mumps	652	1		17		170	233	50	40	53	88
Scarlet fever	347	3		4		92	34	42	20	55	97
Tuberculosis (all forms)	207	17			2	82	29	20	6	32	19
Typhoid and paratyphoid fever	12					10	1			1	
Venereal diseases:											
Gonorrhea	251	8		10	6	56	56	28	18	27	42
Syphilis	70	1		7	2	25	13	3	5	4	10
Primary	5					2	1		1	1	
Secondary	6					4	1				1
Other	59	1		7	2	19	11	3	4	3	9
Whooping cough	147					63	30	6	6	18	24

CUBA

Reported Cases of Certain Diseases—4 Weeks Ended May 26, 1951

Disease	Total	Pinar del Rio	Habana		Matanzas	Santa Clara	Camaguey	Oriente
			Habana City	Total				
Brucellosis	1		1	1				
Cancer	82	3		11	11	30	2	25
Chickenpox	54	1	27	29	1	1	12	10
Diphtheria	17		4	10	4	2		1
Hookworm disease	16			16				
Leprosy	3			2				1
Malaria	6	1		1				4
Measles	56	10	25	29	9	1	1	6
Tuberculosis	66	2		14	13	17	10	10
Typhoid fever	52	8	10	22	1	13	3	5
Whooping cough	42					12	30	

JAMAICA

Reported Cases of Certain Diseases—4 Weeks Ended May 26, 1951

Disease	Total	Kingston	Other localities
Chickenpox	70	15	55
Diphtheria	5	5	
Leprosy	2	1	1
Ophthalmia neonatorum	3	1	2
Tuberculosis, pulmonary	52	14	38
Typhoid fever	62	7	55
Typhus fever (murine)	4	3	1

MADAGASCAR

Reported Cases of Certain Diseases and Deaths—March 1951

Disease	Aliens		Natives	
	Cases	Deaths	Cases	Deaths
Bilharziasis			20	
Diphtheria	1		7	5
Dysentery:				
Amebic	2		137	
Bacillary			20	1
Erysipelas			14	1
Influenza	229		4,832	35
Leprosy			19	
Malaria	274	8	37,232	114
Measles	12		231	5
Meningitis, meningococcal			2	
Mumps	7		330	
Paratyphoid fever	1		1	
Plague			23	17
Pneumonia (all forms)	6	3	561	53
Puerperal infection			4	
Tuberculosis, respiratory	4	1	102	19
Typhoid fever	5		13	
Whooping cough	62		335	2

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently. A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Plague

Indochina. For the week ended June 2, 1951, 2 cases of plague were reported in Cambodia as compared with 12 for the previous week.

Smallpox

India (French). During the week ended June 2, 1951, 27 cases of smallpox were reported in Karikal as compared with 17 for the previous week.

Indochina. During the week ended June 9, 1951, smallpox was reported in ports of Viet Nam as follows: Hanoi 44 cases, Haiphong 30, and Nam-Dinh 11.

Iraq. For the week ended June 9, 1951, 16 cases of smallpox were reported in Iraq.

Yellow Fever

Gold Coast. During the period May 30–June 3, 1951, one fatal suspected case of yellow fever was reported in Nsaba which is about 25 miles north of Winneba.

Nigeria. The fatal suspected case of yellow fever reported June 6, 1951, in Eziachi, Okigwi area, was not confirmed.

Peru. One death from yellow fever was reported Feburary 16, 1951, in San Jose de Sisa, San Martin Department.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work. Articles of special interest are issued as reprints or as supplements, in which forms they are made available for more economical and general distribution.

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Librarians and others should preserve their copies for binding, as the Public Health Service is unable to supply the general demand for bound copies. Indexes will be supplied upon request.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price $4.75 a year; $6.25 foreign.

Public Health Reports

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FEDERAL SECURITY AGENCY

PUBLIC HEALTH SERVICE

FEDERAL SECURITY AGENCY
Oscar R. Ewing, Administrator

PUBLIC HEALTH SERVICE
Leonard A. Scheele, Surgeon General

Division of Public Health Methods
G. St. J. Perrott, Chief of Division

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Public Health Reports

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Pittsburgh Meeting of Public Health Study Section

—An Evaluation of Study Methods—

Some 70 persons concerned with investigations in various aspects of public health met May 10 and 11, 1950, in Pittsburgh, Pa., at the invitation of the Public Health Study Section of the Public Health Service, and the Graduate School of Public Health, University of Pittsburgh. They met to analyze and evaluate methods used in public health research as presented by three groups of investigators conducting studies of (*a*) community health problems; (*b*) diagnostic and therapeutic techniques; and (*c*) long-term trends in morbidity and related phenomena. One of the purposes of the meeting was to provide both the members of the Study Section and prospective applicants for research grants with a consensus of criteria to guide in the formulation and appraisal of applications.

On the basis of critiques and general discussion of the methodology used in 10 studies in these 3 fields, the conferees were asked to analyze the basic principles illustrated and to establish criteria which could serve as guides in planning future research of similar types. The emphasis of the Conference was on methodology in studies of individuals, population groups, and social organizations—studies that cannot be conducted in the rigidly controlled environment of a laboratory.

The members of the Study Section, at the time of the meeting, were Dr. Lowell J. Reed, Johns Hopkins University, Chairman; Dr. Philip E. Blackerby, Jr., W. K. Kellogg Foundation; Dr. Carl Buck, University of Michigan; Dr. Antonio Ciocco, University of Pittsburgh; Maj. C. M. Eberhardt, Department of the Army; Dr. Franz Goldmann, Harvard School of Public Health; Dr. Bascom Johnson, Jr., Veterans Administration; Dr. Hugo Muench, Harvard School of Public Health; George St. J. Perrott, Public Health Service; Marian Randall, Visiting Nurse Service of New York; Dr. Edward S. Rogers, University of California (Berkeley); Dr. Rupert B. Vance, University of North Carolina.

This summary was prepared by Dr. Antonio Ciocco, University of Pittsburgh, and Martha D. Ring, Division of Public Health Methods, Public Health Service.

To give the general framework of the Conference, this review summarizes points brought out in the papers and discussions, indicating the range in objectives, scope, study techniques, and methodological

problems which they illustrated. It concludes with an analysis of essentials that need careful definition, selection, and evaluation to assure the maximum validity of results in any study among groups of people. The principles and standards developed during the Conference are of particular significance since they represent the results of a first attempt at group analysis of public health studies and surveys on grounds of methodology alone.

Methods in Evaluation of Community Health Problems

The four papers in this group illustrate a wide diversity of objectives, techniques, and scope. The first describes the sponsorship, organization, procedures, and content of a Nation-wide survey of the health services received by children. The second gives the details of a study to determine the contribution a medical school can make in improving the medical care provided by physicians in a rural area. The third describes the use of opinion-poll techniques to evaluate the effectiveness of efforts in health education. The fourth analyzes the objectives and procedures of administrative studies of the health needs of a community.

1. Methodology in a Survey of Pediatric Services, by John P. Hubbard and Maryland Y. Pennell.
2. Evaluation of the Extension of Medical School Services to Rural Areas, by Roscoe L. Pullen.
3. Evaluation of Health Education Activities by Opinion-Poll Techniques, by Oscar J. Kaplan.
4. Surveying Community Needs, by Ira V. Hiscock.

The Nation-Wide Study of Child Health Services

One part of an ambitious survey, which included the field of pediatrics education, had two objectives: (1) To collect data that would have more local meaning than could averages for the whole country or a State, and (2) to stimulate the interest of practicing physicians and community health agencies in the provision of more adequate child health services.

The sponsorship of Federal, State, and local groups was essential to both objectives. The study was an almost unprecedented effort to reach all parts of the continental United States and Hawaii under decentralized procedures that were planned and guided to obtain as much uniformity and consistency of results as possible, considering the entire character of the project. Adjustment factors were worked out in detail in an additional sample study to correct for bias that would result from basing the findings for private practice solely on the data furnished by physicians who replied to mail questionnaires.

A major question raised in the discussion of the study related to the decision to attempt 100-percent Nation-wide coverage—a costly

undertaking that could not actually be achieved—rather than to plan for a series of sample studies that could have been subjected to intensive follow-up. The reply indicated that a sample basis was discarded because of the wish to stimulate participation in all States and localities. More than half the States have prepared reports on their health services, and the findings are already being used in recommendations for improvement based on local knowledge of conditions and deficiencies. The statistical value of the data collected has admittedly not been enhanced by the decision to attempt complete coverage, but the enthusiasm and interest created by that attempt have gone a long way toward furthering the study's objectives.

The pediatrics study made no attempt to measure the volume of health services received by children in terms of any standard of adequacy. Presentation of the data was limited to analysis of variations in services among regions, States, and county groups. Standards have been left for later determination by the Pediatrics Committee for the Improvement of Child Health. The State reports will reveal the extent to which the physicians of the State recognize the inadequacy of local services.

Extension of Medical School Services to Rural Areas

This project is designed to ascertain the extent to which the Tulane University Medical School could provide consultant and ancillary services to rural counties which lacked medical facilities and an adequate number of physicians. Like the pediatrics study, and many other types of investigation of community health problems, the Tulane project includes motivation of people as a major objective.

Accurate evaluation of the types of services that the medical school is attempting to provide for rural practitioners was cited as important in view of plans for regionalization of medical services elsewhere. In the discussion of this paper, attention was called to the danger of dual objectives in fact-finding research, since the one objective may conflict with the other. To determine the success of the Tulane project, the discussion brought out, it is necessary not only to have a carefully controlled experiment but also to develop indices that will measure the quality of medical care before and after the practitioners use the medical school services. It was also queried whether the use of a questionnaire on which the physicians answer specific questions is an adequate method of obtaining data unless the data are checked by personal visits.

Answers to these queries indicated that some improvement in medical care could be noted in the increasing willingness of physicians to have Tulane staff members provide consultation in the hospital. Most of the physicians are aged 45 years or over and all have large patient

loads. It has been impossible for them to keep abreast of medical education, and they need ancillary services to reduce the load they carry.

The questionnaire method of obtaining information was supplemented by personal visits to each physician, and some index of the physicians' qualifications was obtained in listing their medical education and training. The Tulane project, as planned, provided opportunity for collection of data in control counties, but the idea of controls was later abandoned. The project, nevertheless, gives some indication that the quality of medical care is improving in that the physicians now use the consultant and ancillary services provided by the medical school.

Opinion-Poll Techniques in Measuring Results of Health Education Activities

An attempt to measure the effect of health education campaigns and the relative usefulness of various media of communication is illustrated in the description of the purposes and methods of a project in San Diego, Calif. Questions were asked before and after an intensive health education campaign conducted by radio, press, and other media, to which both control and experimental groups were exposed. The experimental group received additional material by mail and other means.

As a discussion paper points out, the project shows how a specific technique of measuring attitudes and opinions can be brought to bear on many problems of immediate and practical importance. The project also indicates a method by which controlled experimentation can be carried out in field research on man. One of the first steps in such an undertaking is to perfect the tools of measurement—a step which forms the major part of the project in San Diego.

Surveying Community Needs

This paper, explaining the purpose and scope of community surveys, stresses the need to consider socioeconomic factors and relationships with reference to health problems and reviews criteria for measuring community needs. The paper outlines the historical development and validation of appraisal schedules for community health activities and gives special emphasis to methodological approaches in surveys of chronic illness, occupational health, and school programs. In describing the techniques of neighborhood studies, special attention is given to some of the important questions of purpose, cost, timeliness, and anticipated use of the survey.

As pointed out in the discussion of this paper, motivation of people is one of the main objectives of surveys of community needs—an objective illustrated in all four papers presented in this session of the Conference.

Methods in Evaluation of the Effectiveness of Diagnostic and Therapeutic Techniques

An important aspect of public health research methods is the analysis of the results of various techniques of diagnosis and treatment and of the suitability of these techniques for widespread application. The three papers presented in the second session of the Conference deal with the methodology of studies to determine the effectiveness of nasopharyngeal irradiation on deafness, of influenza vaccination, and of tests for nutritional deficiency. They were followed by two discussion papers and by subsequent explanation of the reasons for choice of certain methods of study.

1. The Efficacy of Nasopharyngeal Irradiation for the Prevention of Deafness in Children, by William G. Hardy and John E. Bordley.

2. Plan for the Evaluation of Vaccination Against Influenza, by Thomas Francis, Jr.

3. Evaluation of Diagnostic and Therapeutic Tests for Nutritional Deficiency States, by Dorothy G. Wiehl.

Nasopharyngeal Irradiation for Prevention of Deafness

A study has been undertaken to determine whether children with impaired hearing and nasopharyngeal lymphoid tissue can be benefited by irradiation treatment and whether the treatment is suitable as a preventive public health measure. This paper gives details of the plan, the selection of children to be studied, the efforts to assure accuracy and validity of observations, the selection of and procedures used for control and treatment groups, and the special problems encountered.

Two reasons were given in the discussion for limiting the groups of children to those with both lymphoid tissue and hearing impairment. In the first place, since about three-fourths of all children in the age group studied have hyperplastic nasopharyngeal lymphoid tissue, some other limitation on selection would have been necessary to keep the numbers studied within manageable proportions. In the second place, the irradiation technique used is specific for lymphoid tissue but not for hearing. In addition, to reduce subjective factors, it was decided to use a screening technique (pure-tone audiometry) that an adequately trained field staff can utilize accurately. The 8 or 10 categories of lymphoid tissue are difficult to classify and not sufficiently standardized for objective screening. Practical considerations and the wish to pin screening down to a specific symptom dictated the decision to restrict the study to children with hearing impairment.

Subjectivity in the experiment is avoided by keeping those who give the irradiation treatment unaware of which children receive irradia-

tion. The physician who records the results of the examinations of lymphoid tissue during the course of the study dictates the findings to a recorder without reference to records of previous findings.

The decision to cease withholding irradiation from any child in the control group if the child might benefit from the treatment has not yet been exercised. Parents were told that all children in the control and experimental group would receive periodic examination and that some would get treatment that might benefit them, though no predecision was made that the treatment would be beneficial. Most of the children in the study had subclinical conditions for which physicians would rarely be consulted. Children may be lost from both control and experimental groups when they go to clinics or physicians for treatment. Records are kept of any other treatment received by any of the children.

Evaluation of Vaccination Against Influenza

This paper gives a detailed account of the plan, organization, and procedures of a study to determine the effect of influenza vaccination on students in the Army Specialized Training Program in nine universities. Important in such studies are the homogeneity, stability, and size of the population to be studied, adequate supplies of standardized vaccine to be administered, timing of the vaccination (since the duration of the effect of the vaccine is not known), uniformity of procedures, close observation by competent investigators, confirmation of diagnosis, and adequate controls.

In response to a question raised in a discussion paper regarding the preferability of a prison type of population in research of this character, the main objective of the study was explained as primarily an effort to determine whether influenza vaccination would be of value in a military population. It was therefore decided to choose a population having approximately the same age characteristics and living conditions as the military. Earlier studies had been set up in institutions, but it proved difficult to induce infection with safe materials.

Some correlation was found between vaccination and immunity. The plans for the investigation included study of antibody titers in the experimental group before immunization and in the control group before exposure. Variation in influenza strains presents one problem, and the fact that only 20 percent of the people in the exposed control group get sick is another. No clear correlation is found between antibody level and susceptibility.

Evaluation of Tests for Nutritional States

The multiplicity of variables that must be analyzed and controlled in research on population groups is clearly indicated in this paper on methodology in studies of nutritional deficiency states. Diagnostic

criteria must be valid, objective, clearly defined, and held constant. Comparability of "control" and "experimental" groups must be established initially and evaluated periodically in terms of age, sex, developmental stage, genetic and environmental factors, deficiency status, nondietary conditioning factors, and dietary factors.

The complexity of the problem is illustrated by the fact that more than 50 known nutrients have a potentially equal number of nutritional deficiency states. The signs of deficiency can be accurately observed through X-ray and clinical photography in some instances, but it is difficult to isolate signs of single, specific deficiencies.

Problems of study methods in this and in the two other papers presented in this session, as one of the discussion papers pointed out, derive from difficulties in determining the size of the sample to be studied; in grading the results of diagnosis to establish critical points dividing positive from negative diagnoses on a scale that runs all the way from true positive to true negative; and in providing the most sensitive, specific, and objective diagnostic tests possible.

Methods in Long-Term Studies

The three papers giving methodological details of studies that extend over long periods, even a generation or more, bring out many of the same questions of sampling, standardization of measuring tools and observations, and consideration of environmental and social factors that may affect the findings that were brought out in the discussions of the two other groups of studies.

The first paper in the series is on longitudinal studies of child health and development. The second describes the base for epidemiological studies of chronic illness in the matched population records of the Eastern Health District of Baltimore. The third is a description of methods used in recent long-term morbidity studies in Hagerstown, Md.

1. Certain Technical Aspects of Longitudinal Studies of Child Health and Development, by Harold C. Stuart and Robert B. Reed.

2. Matched Population Records in the Eastern Health District, Baltimore, Md.: A Base for Epidemiological Study of Chronic Disease, by W. Thurber Fales.

3. Recent Long-Term Morbidity Studies in Hagerstown, Md., by Philip S. Lawrence and Clark Tibbitts.

Longitudinal Studies of Child Health and Development

The phase of this long-term project described is an attempt to measure the volumetric growth of subcutaneous tissue in a longitudinal section at the broadest part of the calf of the right leg. Since a high degree of correlation is found for volumetric growth of muscle, bone, and subcutaneous tissue, it is hoped that a method of combining observations on children can be developed to determine the relationships of illness and disabling conditions to growth patterns.

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The study is still in progress, and the relation of the findings on growth to health raises difficult questions of defining positive health and its gradations. The effects of specific short-term illness are being noted, but in many instances are found to be only temporary. Constants for development have not been used as such, but it is hoped that the development of one tissue can be related to the development of another tissue to observe differences in rates of growth.

If sample cross sections of different age groups had been used for study instead of long-term measurement of the same children, it would have been possible to determine different stages of development at different ages. Valid indices, however, would have required very large numbers of children in each age group. Furthermore, the cross-section study would have shown nothing of individual development or of growth rates at different ages, the objective of the present study. Establishing a cumulative index of health and development is a serious part of the problem. Comparisons of rates of tissue growth and rates of short-term illness have not yet been made. Relationships of height and body weight are available and can eventually be compared with health records.

Matched Population Records for Study of Chronic Disease

This paper on studies in the Eastern Health District of Baltimore, Md., gives an account of the historical development, purposes, and uses of the census records maintained for families and their individual members in certain areas of Baltimore for a quarter century.

Discussion of this paper centered on the application of the method to other areas. An ideal plan would perhaps involve keeping a continuous register of all individuals and households. An unqualified "yes" was the response to the question whether, after 20 years' experience, the investigator would use census records rather than a continuous name file if the studies were started afresh. The censuses conducted every 3 years provide a close check on over-all population movements. Any substitute in the form of current files would be expensive and time-consuming and no matter how carefully maintained, would need periodic checks. The Baltimore experience has shown the difficulty of matching records from one census to another. The 1945 addition of information to the basic records to show the maiden name of the wife, date of marriage, and previous residence has aided the process of tracing people.

Discussion turned to the problems of obtaining accurate information on illness illustrated by the various studies conducted by the Public Health Service. Some data on illness in the Eastern Health District in Baltimore were taken from medical records in institutions. In the 5-year morbidity study in 1938–43 housewives gave information, and diagnoses were verified by clinics and attending physicians.

The frequency of interviews needed in a morbidity study depends on the type of information to be collected. In studying chronic illness, for example, prevalence data may be about as useful as incidence data and are much easier to get. Prevalence of chronic illness measured by the number of cases disabling at a given time or at some time during a given period can be ascertained with fair accuracy by visits once a year, since the rates are not subject to much seasonal variation.

On the other hand, weekly or semimonthly visits are necessary to determine the incidence or prevalence of nondisabling acute illness, particularly for the minor respiratory diseases. Frequent visits, however, introduce problems of determining new cases as distinct from those that have carried over from a preceding period. More frequent visits increase the cost of the studies.

As a compromise, in a morbidity study on a broader scale, a new sample of households might be visited each month, and the prevalence of chronic illness recorded at each visit. In a year, such a study would furnish prevalence data for 12 times the number of households in each monthly sample. Accurate information on acute diseases could be recorded for the month preceding the visit, and the year's record would yield incidence data for acute conditions during 12 months which would roughly eliminate seasonal variations.

The difficulty of obtaining comparable data for, say, 10,000 individuals who are examined by several different physicians was indicated at this point. As to illness, it is easier to get comparable data in terms of disabling cases and those confined to bed, than for nondisabling cases. However, since chronic diseases are frequently nondisabling for long periods, it seems advisable to record at least this type of nondisabling illness. In the Baltimore survey "confined to house" was used as a more objective classification than "disabling," particularly in recording illness among children and adults who were not gainfully employed. The recorded "house cases" were of about the same frequency as "disabling cases," but the total number of days confined to house was considerably less than the total days of disability.

In this connection, the discussion stressed the need for health status studies so that data can be obtained for normal and well people also. The gap between clinical and public and preventive medicine needs to be bridged by studies of large groups of people who undergo thorough clinical examinations which will reveal their health status. Answers to simple questions put by an investigator are not enough, nor is mass screening alone sufficient. Furthermore, all factors in the social environment that have a bearing on health should be correlated with health findings. We now rely too heavily on income data alone.

Long-Term Morbidity Studies in Hagerstown

The Hagerstown studies, initiated in 1921, have provided a wealth of data that form part of the permanent records which are being organized in a family file. This paper indicates some of the methodological problems in connection with collection and verification of reports on illness and the need for new techniques for reporting in longitudinal studies. The multiple screening examination and symptom check-list, now in exploratory stages, merit study for this purpose. Problems of choosing the informant, of changes in the composition of the original population cohort, and of the intervals between observations were also stressed. Longitudinal studies offer great promise in obtaining information on the incidence and progress of chronic illness, the interrelation of illness and socioeconomic factors, and use and effectiveness of treatment programs. An essential for success is effective advance planning for the long-term period of study.

As pointed out in one of the discussion papers, long-term studies are apparently here to stay. The session on this group of studies was characterized as, in itself, a complete justification for the Conference. Studies stimulated by the discussion of methodology should considerably narrow the gap in present knowledge of how to obtain valid and useful data in public health studies.

Methodological Principles Illustrated

The range of public health research in communities and population groups is both broad and deep, as illustrated by the papers presented. A special committee appointed by the National Advisory Health Council has classified this research in five main groups:

1. Studies related to the extent and distribution of diseases or other public health problems in a community, population, or part of a population.
2. Studies on a community, population, or group basis, in relation to the pathogenesis or dissemination of diseases of public health importance.
3. Studies of the effectiveness of prophylactic or therapeutic procedures on a community, population, or group basis.
4. Studies designed to test the significance of a laboratory or clinical finding, or to test the validity of a laboratory technique, on a community, population, or group basis in relation to problems of public health importance.
5. Studies in public health methods.

The last group is further subdivided into four categories:

(*a*) Studies designed to solve organizational and administrative problems faced by health agencies in the mass application of new methods of diagnosis, prevention, and control of diseases of public health importance, and in the application of new measures for the maintenance of health.

(*b*) Studies designed to test or develop epidemiological methodology, or other specialized methodology used or presumably useful in public health practice.

(*c*) Studies of the productivity of public health practices already in process.

(*d*) Studies of the applicability of theories and hypotheses in public health organization and administration.

The broad scope of this research has resulted from the great medical discoveries that have revealed the relationships between health and disease and biological and social environment. The field of inquiry includes, broadly, determination of health needs, of factors associated with illness, development and improvement of the means of meeting health needs, and methods of applying the knowledge public health possesses and will possess. It is clear from the breadth of the professional field of public health that its prime purpose is to study man, not only as an individual, but also in his social and economic setting.

The methodological principles illustrated in the papers presented, and some of the problems encountered in maintaining those principles may be summarized under three heads: objectives, measurements, and controls. Following the discussion of these three points is an outline which evolved from the Conference as a checklist for evaluation of the soundness of a research project in its advance planning.

Objectives

A clear formulation of objectives is recognized as an essential first step in planning investigations in public health. This step is needed (1) to make sure that the study meets a recognized need for information, (2) to assure that the data collected will provide that information, (3) to keep the projects within manageable proportions, and (4) to obtain the financial support and other backing that will enable the investigators to undertake and complete the job.

Several types of objectives can be identified in the papers presented at this Conference. One objective is to increase scientific knowledge. Another is to learn the dimensions of a given problem or condition as a basis for social action. Another is to bring about social action as part of the study process. As the papers also indicate, a single project may have more than one objective. Many include motivation of people as a major purpose, while at the same time the project is designed to measure the extent of need for social action. The major difficulties arise when one of these objectives complicates or defeats accomplishment of the other.

In this connection, it may not be amiss to distinguish between surveys with research objectives and those aimed at motivating changes in social behavior. When undertaken for purposes of research, a survey is designed solely to increase knowledge by discovering the relationship between two or more variables within a systematic frame of reference. Its findings are then universally applicable under the conditions described. On the other hand, when a survey is designed to motivate social action, the facts and relationships revealed are likely to be applicable only to a highly specific time, place, or other condition.

Measurements

Rules governing careful definitions of the problems of investigation and precision in the selection of instruments apply equally to all types of studies. The units of count used may range from inches and pounds in measuring height and weight to days in bed for measuring severity of illness. They may include counts of the number of pathological examinations as well as the number of questionnaire responses expressing specific attitudes or opinion on a given question. In the relatively new and ever broadening field of public health studies, pioneering is still in progress in developing valid units which will measure social and economic phenomena and illness.

Many of the observations recorded in these studies run the danger of being colored by subjective factors among observers. Moreover, many of the things to be measured are intangible. Training and instruction of observers, tests to take account of their individual differences, and reduction of procedures to the simplest and most concrete terms will help to counteract the handicaps of using human tools to measure human phenomena.

In studies of diagnostic and therapeutic techniques it must be remembered that no technique is a perfect instrument. The technique may, for example, overdiagnose, exaggerating the true severity or prevalence of the conditions and classifying some negatives as positives. On the other hand, the technique may be adequate in identifying minimal cases and fail, as does the tuberculin test, in far-advanced cases.

These imperfections in diagnostic techniques must be judged in relation to their importance to the problem under investigation. In nutrition studies, for example, little harm may result from overdiagnosis and from subsequently prescribing unnecessary supplemental feeding. At the other extreme, erroneous designation of a person as syphilitic, tuberculous, or cancerous may entail far more serious consequences than would failure to diagnose a true positive. Issues such as these must be carefully weighed in establishing the techniques of the study.

The participants in the Conference focused considerable attention on the question of developing adequate indices to measure the quality of medical care. Among the measurements of diagnosis and therapy cited were the statistical indices derived from frequency of autopsies, pathological examination of tissues, hospitalization, referrals by general practitioners to specialists, and check of the accuracy of initial diagnosis by general practitioners and specialists against subsequent findings. Certain indices of quality of services are available and have been employed in varying degrees in statistics on hospital care and other services.

While it was recognized that units of measurement used in evaluating health programs must inevitably change with advances in medicine, definite criteria were held likely to remain constant for a long time. For most studies, the most adequate gage of quality of medical services at any period is the best practice then current. Realism is necessary, however, in considering such questions as the investment society is willing to make in providing medical care of high quality—a question no technician can answer. Other practical issues involve the range of special services that should be made available for limited numbers of people such as those on ships, and the decisions that must be made in setting standards for minimal services, such as the components of physical examinations for each age group.

Controls

The conferees pointed out that adequate controls or means of comparing one surveyed group with another are as essential in public health research as in any other type of scientific investigation. The need for predetermining the differences and similarities among groups in setting up controls was also stressed. Control areas or groups should have the same characteristics as the experimental areas or groups. Attention was called to the often-repeated contention that controls cannot be set up for service projects because the control areas or groups are affected either by the initial survey or by the project in the allied experimental group. If such effects are noted in the control group, however, either the control setup or the project itself was probably not well planned. Thus, if it were proposed to demonstrate that a certain type of immunization decreased susceptibility to the common cold, and if people in the control group were to have the immunization on their own accord, the project was not adequately planned to determine whether the immunization campaign affected the incidence of colds.

In tests of the efficacy of therapeutic techniques the problem is to evaluate the treatment as a means of curing or at least preventing the progression of the condition. This procedure requires an adequate device for selecting the impaired persons in the population, dividing them into comparable groups, giving one group the treatment to be tested, and giving the other group identical treatment except for the presence of the therapeutic agent. The two groups are then followed to observe cure or progression rates. The practical, ethical, and public relations problems of withholding the treatment from the control group were recognized. The benefits to be derived from conclusive results of the experiment are so great, however, that suitable controls should always be employed, and practical difficulties in conducting control studies should not be considered insurmountable.

Criteria for Field Studies

I. The objective or purpose of the study should be:
   1. Simple and direct;
   2. Clearly defined;
   3. Related to one or, at most, two facets of the basic problem to avoid dispersion of effort and meaningless results;
   4. Capable of conclusive results with facilities and materials available;
   5. Held constant during the experiment;
   6. Applied critically to all items and phases of the experiment to determine their significance.

II. The measurements used should be:
   1. Objective;
   2. Repeatable by different observers and at different times;
   3. Efficient in terms of clear and mutually exclusive divisions, undistorted scale, and broad range of values to be recorded;
   4. As simple, generally available, easily performed, and inexpensive as possible;
   5. Accurate in sensitivity and specificity;
   6. Tested in pilot study.

III. Groups to be studied should be:
   1. Representative;
   2. Cooperative;
   3. As completely comparable as possible---every effort should be made to extend this comparability to all variables other than those under examination (control and experimental groups);
   4. Available for continuous observation;
   5. Large enough to provide samples of adequate size to yield statistically meaningful results;
   6. Screened in relation to the purposes of the study;
   7. Tested in pilot study to determine extraneous factors.

IV. The collection of data should include:
   A. Written instructions which:
      1. Specify objectives of the study;
      2. Contain definitions of terms;
      3. Are clear and specific;
      4. Give rules for recording;
      5. Indicate frequency of observations;
      6. Are tested in pilot study.
   B. Staff for the study which is:
      1. Competent in use of techniques;
      2. Free of personal bias;
      3. Able to maintain good public relations;
      4. Adequately trained in pilot study.

C. Record forms which are:
  1. Clear;
  2. Convenient;
  3. Prescribed;
  4. Tested in pilot study;
  5. Related to plans for final tabulations.

V. Results of study should be:
  1. Related to objectives;
  2. Valid within stated intervals of reliability;
  3. Evaluated in light of assumptions and methodology;
  4. Generalized only with realization of limitations of the data.

Criteria that are particularly applicable to studies evaluating diagnostic and therapeutic techniques may be worded as follows:

A. Preliminary laboratory or clinical studies of the technique to determine its:
  1. Precision;
  2. Accuracy;
  3. Effectiveness of use by observers;
  4. Side effects;
  5. Costs.

B. Field tests to determine effectiveness in detecting:
  1. Absence or presence of condition under investigation;
  2. Ranges in variations from normal through abnormal conditions;
  3. Specificity in differentiating among diseased conditions.

C. Population studied should:
  1. Be representative of the universe under discussion;
  2. Include persons with commonly occurring miscellaneous disease;
  3. Exclude volunteers who may introduce spurious correlations.

D. Conduct of experiment should:
  1. Recognize disease as a dynamic state; either progressing or regressing;
  2. Make serial observations on both test and normal groups to:
     (*a*) assess full value of test;
     (*b*) ascertain complete effect of procedure;
  3. Ascertain stability and progression of successive readings;
  4. Determine difference in progression rates between normal and other groups;
  5. Provide follow-up to determine permanency of results.

Recent Court Decisions on Municipal Milk Inspection

By Murray Stein and Israel L. Sonensheim*

Recent litigation has thrown further light on the type of requirements a municipality, in protecting the health of its inhabitants, may validly impose with respect to the location of milk production, processing, and pasteurizing facilities as a condition to the offering of milk or milk products for sale within the municipality.

Since the Congress has not spoken to the contrary, the Supreme Court of the United States has recognized that milk regulation for the protection of public health lies within the sphere of State authority even though interstate commerce may be affected (*1*). Under validly delegated power, expressed or implied, from a State, the right of a municipality to regulate the preparation, care, custody, and delivery of milk to protect the public health is well settled. The Supreme Court has recognized that in the exercise of such powers a municipality may appropriately apply regulations to milk and milk products originating in remote areas in the interest of the safety, health, and well-being of its inhabitants (*2*).

Milk and milk products are not only necessary articles of food, but also are perfectly lawful subjects of commerce. Their flow in the ordinary currents of trade and commerce, whether interstate or intrastate, may not be abridged by municipalities or other governmental bodies further than reasonably necessary to protect and safeguard the public health (*3*). The reasonableness of an ordinance relating to location of pasteurization and processing plants and inspection of sources of supply of milk and milk products depends on the purpose to be accomplished by the ordinance and the effect upon all who must comply with it (*4*).

Interstate Competition Upheld

The Supreme Court of the United States in *Dean Milk Company* v. *Madison* (*5*) recently held invalid[1] as discriminatory against interstate commerce provisions in a municipal ordinance, enacted by a city in Wisconsin, which made it unlawful to sell any milk within the municipality as pasteurized milk unless it had been processed and bottled at an approved pasteurization plant within a radius of 5 miles from the central city square. The ordinance was contested by a

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[1] Justices Black, Douglas, and Minton dissenting.

corporation whose pasteurization plants were located in Illinois and which was denied a permit to sell its products within the Wisconsin municipality solely because its pasteurization plants were more than 5 miles away. The milk which the shipper sought to sell was supplied from farms and processed in plants licensed and inspected by public health authorities of Chicago. It was also labeled "grade A" under the Chicago ordinance which contains the grade A standards recommended by the Public Health Service.

The Court found that the municipal requirement that all milk be pasteurized at a plant within 5 miles from the center of the city constituted an economic barrier which protected a major local industry against competition from outside the State, and thus plainly discriminated against interstate commerce. A municipality cannot curtail interstate commerce, the Court held—even in the exercise of its unquestioned power to protect the health and safety of its people—if reasonable nondiscriminatory alternatives adequate to conserve legitimate local health interests are available. The following were then listed as available, reasonable, and adequate alternatives:

1. Inspection by municipal officials of distant milk sources for which the receiving municipality could charge the actual and reasonable cost of such inspection to the shipping producers and processors.[2]

2. Adoption of Section 11 of the Model Milk Ordinance recommended by the Public Health Service. This section imposes no geographical limitation on location of milk sources and processing plants, but excludes from the municipality milk not produced and pasteurized conformably to standards as high as those enforced by the receiving city.

In implementing such an ordinance, the importing city may obtain ratings on milk and milk products of distant origin based on uniform standards which have been put into effect by health authorities in the jurisdiction where production and processing occur. The receiving city may determine the extent of enforcement of sanitary standards in the exporting area by verifying the accuracy of safety ratings of specific plants or of the milkshed in the distant jurisdiction through the Public Health Service's spotchecks of local ratings.

Another section of the municipal ordinance, considered by the Supreme Court in the Dean case, prohibits the sale of milk, or the importation, receipt, or storage of milk for sale in the municipality unless it comes from a supplier possessing a permit issued after an

[2] In *Miller* v. *Williams*, 12 F. Supp. 236 (D. C., Md. 1935), while a municipality was held to be without authority to bar milk and milk products from another State merely because of alleged impracticability of adequate and effective inspection by its own representatives of remotely located producers and pasteurizing plants, it was held to have authority to impose regulations which would afford every reasonable assurance to the local authorities for the protection of the health of the community. It was pointed out by the Court that, in lieu of personal inspection by its officials, the municipality probably could require certificates from appropriate officials of other States attesting that specified standards have been met.

inspection by officials of the receiving municipality. This provision was attacked by the shipper insofar as it expressly relieves municipal authorities from any duty to inspect farms located beyond 25 miles from the center of the city. The State Supreme Court thought it unnecessary to pass upon the validity of the 25-mile limitation, apparently, in part, because this issue was made academic by its decision upholding the 5-mile section. As the United States Supreme Court held the 5-mile section to be an unreasonable burden on interstate commerce, the determination of the validity of the 25-mile section is now necessary. Thus, the case was remanded to the State court for further proceedings not inconsistent with the principles announced by the United States Supreme Court in its opinion on the 5-mile section. The section containing the 25-mile limitation seems to be open to legal objections similar to those arising in consideration of the 5-mile section.

Interstate Practices Vary

Although the Supreme Court of the United States has held that local ordinances are invalid when they exclude wholesome milk or milk products shipped from a point outside the State, unless they have been pasteurized or produced within a specified local area, the State court decisions are divided as to the validity of such provisions when they are applied to milk or milk products produced or processed at a distant point within the same State. In the absence of overriding State statutes, the State of California (*6*), Georgia (*7*), New York (*8*), Texas (*9*), and Wisconsin (*10*) have indicated that local ordinances which require milk to be pasteurized or processed within a prescribed inspection area are valid.[3] When the State Legislature, however, has taken to itself the field of inspecting the production and processing of milk and milk products, the local authorities do not have the power to pass a valid ordinance imposing an area of inspection limits (*11*), and milk and milk products which meet State requirements may not be excluded by local authorities. Thus, subsequent court decisions in California[4] and Texas (*12*), which have since enacted general

[3] The Supreme Court of Minnesota, however, has held that an ordinance which required milk to be pasteurized in plants located within a city's limits set up too limited an inspection area, and was unconstitutional as unreasonably violating the property and contract rights of a shipper of milk located 30 miles from the municipality and within the same State as the municipality. *State* v. *City of Minneapolis*, 190 Minn. 138, 251 N. W. 121 (1933).

[4] In *LaFranchi* v. *City of Santa Rosa*, 8 Cal. (2d) 331, 65 P. (2d) 1301 (1937), an ordinance prohibiting the sale of pasteurized milk in a municipality unless the milk is pasteurized within the corporate limits of the municipality was held invalid when the producer was within the same State inspection district as the municipality. The ordinance was found to be in conflict with overriding State statutes giving the State supervision of milk inspection services and providing for the right of sale of State inspected milk in the district in which the milk is inspected and graded. Distinguished from *Witt* v. *Klimm*, 97 Cal. App. 131, 274 P. 1039 (1929), which dealt with milk brought in from another inspection district. See also *Meridian Limited* v. *Sippy* 54 Cal. App. (2d) 214, 128 P. (2d) 889 (1942).

State laws governing the inspection of the processing and production of milk, have held invalid local ordinances which excluded milk not eligible to be inspected by officials of the enacting municipalities.

The Supreme Court of Illinois, in a series of decisions, had held invalid local ordinances which prohibit the sale of milk or milk products within a municipality unless processed or produced within a specified area reaching more than half a mile beyond the municipal limits (*13*). The Illinois ordinances were declared invalid because they constituted, in the court's opinion, attempts by the municipalities to exercise territorial jurisdiction beyond the powers conferred on them by State legislation. The State law provides that municipalities are to have jurisdiction over all places within one-half mile of the corporate limits for the purpose of enforcing health and quarantine ordinances and regulations. The Illinois court has also relied on the fact that no means was left available whereby sale of wholesome milk pasteurized or produced outside the city could be made legal. Finally, the State court stressed the lack of any contention that the only reasonable manner in which a city can inform itself of the quality of milk brought into the city is by its own inspection at the source of supply and the pasteurizing plant (*14*).

A municipality in Illinois has been held without authority to conduct inspections of sources of milk and milk products located outside its territorial jurisdiction (*15*). In most jurisdictions, however, municipalities are authorized to exercise certain extraterritorial functions for the preservation of public health. Such functions include inspection of sources of milk and milk products with or without a right to charge a reasonable fee therefor (*16*).

Summary

In summary, the courts have consistently upheld ordinances of municipalities regulating milk and milk products for the protection of the health of its inhabitants, if the power to promulgate such ordinances is validly delegated to the municipality by the State, and if the ordinances are otherwise consistent with relevant State law. The creation of a limited inspection area within which milk must be pasteurized, processed, and bottled as a condition precedent to inspection is invalid as discriminatory against interstate commerce when reasonable nondiscriminatory alternatives sufficient to protect local health interests are available. Such reasonable alternatives include either the inspection by municipal officials of distant milk sources or the adoption of section 11 of the Model Milk Ordinance recommended by the Public Health Service, which excludes from the municipality milk which does not conform to production and pasteurization standards as high as those enforced by the receiving city.

REFERENCES

(1) *Dean Milk Co.* v. *Madison*, 340 U. S. 349 (1951); *Milk Control Board* v. *Eisenberg Farm Products*, 306 U. S. 346 (1939); *Baldwin* v. *G. A. F. Seelig, Inc.*, 294 U. S. 511 (1935).
(2) *Dean Milk Co.* v. *Madison*, supra.
(3) *Miller* v. *Williams*, 12 F. Supp. 236 (D. C., Md. 1935); *Prescott* v. *City of Borger*, 158 S. W. (2d) 578 (Texas, 1942); *Grant* v. *Leavell*, 259 Kentucky 267, 82 S. W. (2d) 283 (1935); *Lang's Creamery* v. *City of Niagara Falls*, 231 N. Y. S. 368 (1928); *Whitney* v. *Watson*, 85 N. H. 238, 157 A. 78; *Cofman* v. *Ousterhous*, 40 N. D. 390, 168 N. W. 826.
(4) *Dyer* v. *City Council of City of Beloit*, 250 Wis. 613, 27 N. W. (2d) 733 (1947).
(5) 340 U. S. 349 (1951).
(6) *Witt* v. *Klimm*, 97 Cal. App. 131, 274 P. 1039 (1929).
(7) *Trotzier* v. *McElroy*, 186 S. E. 817 (Georgia, 1936).
(8) *Lang's Creamery* v. *City of Niagara Falls*, supra.
(9) *McKenna* v. *City of Galveston*, 113 S. W. (2d) 606 (1938).
(10) *Dyer* v. *City Council of Beloit*, supra.
(11) *Associated Dairy Products* v. *Paige*, 63 Ariz. 393, 206 P. (2d) 1041 (1949).
(12) *Prescott* v. *City of Borger*, supra.
(13) *Dean Milk Co.* v. *City of Aurora*, 404 Ill. 331, 88 N. E. (2d) 827 (1949); *Dean Milk Co.* v. *City of Waukegan*, 403 Ill. 587, 87 N. E. (2d) 751 (1949); *Higgins* v. *City of Galesburg*, 401 Ill. 87, 81 N. E. (2d) 520 (1948).
(14) *Dean Milk Co.* v. *City of Waukegan*, supra.
(15) *Dean Milk Co.* v. *City of Elgin*, 405 Ill. 204, 90 N. E. (2d) 112 (1950).
(16) *Terry Dairy Products Co.* v. *Beard*, 216 S. W. (2d) 860 (Arkansas, 1949); *City of Newport* v. *Hiland Dairy*, 164 S. W. (2d) 818 (Kentucky, 1942). But cf. *McClendon* v. *City of Hope*, 230 S. W. (2d) 57 (Arkansas, 1950); *City of Abilene* v. *Tennessee Dairies*, 225 S. W. (2d) 429 (Texas, 1949).

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ending June 23, 1951

For the current week 211 cases of poliomyelitis were reported as compared with 162 for the preceding week. For the corresponding current week, 335 and 408 cases were reported for 1950 and 1949, respectively. States reporting 10 or more cases for the current week were: Alabama, 18; California, 28; Florida, 10; Louisiana, 13; Oklahoma, 13; and Texas, 33.

Epidemiological Reports

Meningococcal Meningitis

Dr. A. L. Gray, Mississippi State Board of Health, reports an outbreak of meningococcal meningitis involving two related and associated families. The first date of onset was May 17. The infection was of fulminating type with meningococcemia heavily involved and was spread apparently by direct familial association. Of the five cases, three died. All contacts of these cases were given prophylactic treatment.

Infectious Hepatitis

Dr. I. J. Tartakow, Epidemiologist, Nassau County New York Health Department, reported five cases of infectious hepatitis in Baldwin. The first case developed in a salesman on June 21, and later in three of his children and a neighbor. The source of the infection is unknown.

Dr. Tartakow also reports five cases of infectious hepatitis in a rooming house in Hempstead. The onset of the first case was April 6. Four cases occurred among 19 adult occupants and 1 case among the 7 children. An additional case occurred in an adult contact. The first case was in a 2-year-old child who presumably contracted the disease while visiting a relative who developed hepatitis 20 days later. The cases were confined to the six families using a common kitchen. The other eight boarders not using the common kitchen were not affected. The kitchen showed evidence of rodents, improper garbage disposal, and need for general cleanliness.

Food Poisoning

Dr. S. S. Farnsworth, Oakland, Calif., Health Director, and the San Francisco District Inspector, Food and Drug Administration, report that approximately 300 of a total of 750 employees of the Highland Hospital, were ill with food poisoning April 29. The illness was chiefly diarrhea with little vomiting. All personnel returned to work the next day. Preliminary investigation indicates the causative agent was probably poorly cooked turkey. Further investigation will continue under city and State public health officers. No food of interstate origin was apparently involved.

Gastroenteritis

Dr. J. C. Hart, Connecticut Department of Health, reports two outbreaks of gastroenteritis in a private school occurring 6 days apart. Both followed turkey dinners. In the first, about 65 out of a total of 135 were ill; and in the second, about 70. In both, the incubation period was 10 to 24 hours. Both outbreaks were characterized chiefly by abdominal pain and diarrhea. Most cases recovered in about 12 hours. Reports on cultures of the turkey and stools of the food handlers are not available.

Influenza

The Influenza Information Center, National Institutes of Health, reports the study of a strain of influenza virus submitted from Puerto

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	June 23, 1951	June 24, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	------	1	1	(1)	(1)	(1)	(1)	39	20	26
Diphtheria (055)	48	44	98	27th	4,826	7,280	10,786	1,919	3,009	4,428
Encephalitis, acute infectious (082)	23	27	11	(1)	(1)	(1)	(1)	425	344	225
Influenza (480–483)	575	275	312	30th	129,281	148,163	148,163	114,739	137,579	127,352
Measles (085)	11,802	10,097	10,678	35th	456,576	276,598	539,754	427,875	257,469	504,808
Meningitis, meningococcal (057.0)	59	73	57	37th	3,349	3,121	3,032	2,388	2,207	2,060
Pneumonia (490–493)	694	987	(2)	(1)	(1)	(1)	(1)	[3] 41,635	54,207	(2)
Poliomyelitis, acute (080)	211	335	309	11th	[4] 1,278	1,658	1,658	[4] 2,491	2,789	2,006
Rocky Mountain spotted fever (104)	16	19	22	(1)	(1)	(1)	(1)	110	146	154
Scarlet fever (050) [5]	914	631	1,018	32d	65,998	54,269	78,148	50,307	37,830	55,604
Smallpox (084)	1	------	1	35th	15	44	66	7	23	45
Tularemia (059)	17	20	20	(1)	(1)	(1)	(1)	339	496	497
Typhoid and paratyphoid fever (040,041) [6]	57	88	88	11th	614	818	849	1,049	1,328	1,334
Whooping cough (056)	1,297	2,653	2,052	39th	[7] 59,644	88,432	80,315	[7] 38,042	66,916	49,049

[1] Not computed. [2] Data not available. [3] Additions: Week ended June 16—West Virginia 6 cases, Florida 15, Utah 2; week ended June 9—Tennessee 23. [4] Deduction: North Carolina, week ended June 9, 2 cases. [5] Including cases reported as streptococcal sore throat. [6] Including cases reported as salmonellosis. [7] Addition: West Virginia, week ended June 16, 13 cases.

Rico. This strain was isolated in May from a case of influenza occurring during the recent outbreak in Puerto Rico. Antigenic analysis of the strain indicates that it is rather closely related to strains isolated during the outbreaks in Europe and in America during the past winter.

Dr. E. H. Lennette, California State Department of Public Health at Berkeley, reports a significant increase in titer by the complement-fixation test against influenza B virus in one paired serum specimen from a patient whose onset of illness was in May.

Diphtheria

Dr. D. H. Stevens, Maine Department of Health and Welfare, reports an outbreak of 10 diphtheria cases in a State hospital. The first case was in an attendant, whose source of infection was not discovered. The onset was on May 6. Since that time two other attendants and seven patients have contracted diphtheria with one fatal case (a patient, aged 65).

Dr. W. L. Halverson, California Director of Health, supplements a previous report of diphtheria in one of the northern counties. During May, 10 cases were reported. Two of the cases were in nurses aides (ages 21 and 48 years) who had had contact with two patients before the diagnosis of diphtheria was established. One case was in a hospital janitor (age 69 years) and two others were in ward patients of this hospital (ages 82 and 86 years). Some of these cases were mild. Cultures from six cases were submitted for typing to the School of Public Health, University of California, Berkeley.

Reported Cases of Selected Communicable Diseases: United States, Week Ended June 23, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**48**	**23**	**575**	**11,802**	**59**	**694**	**211**
New England	**4**	**2**		**986**	**6**	**29**	**2**
Maine	1			59	2	2	
New Hampshire				47	2	3	
Vermont				58			
Massachusetts	3	2		581	2		
Rhode Island				26		3	
Connecticut				215		21	2
Middle Atlantic	**4**	**8**	**1**	**2,608**	**16**	**60**	**13**
New York	3	4	[1] 1	1,248	9	7	9
New Jersey		4		763	1	23	4
Pennsylvania	1			597	6	30	
East North Central	**6**	**5**	**6**	**2,786**	**10**	**75**	**33**
Ohio	1			783	5		5
Indiana	2	1		44		8	4
Illinois		1	4	361	2	28	8
Michigan		3	2	360	2	39	7
Wisconsin	3			1,238	1		9
West North Central	**5**		**8**	**649**	**4**	**39**	**15**
Minnesota			2	190		8	4
Iowa				18			1
Missouri	2		3	182	2		2
North Dakota			3	106	1	18	2
South Dakota	3			15			
Nebraska				10			3
Kansas				128	1	13	3
South Atlantic	**10**	**4**	**140**	**1,044**	**7**	**83**	**18**
Delaware				29			
Maryland			1	324	1	27	
District of Columbia				52		10	
Virginia	1	1	120	329	1	28	
West Virginia	1			59			
North Carolina	3	1		46	2		3
South Carolina	3		8	19	3	5	2
Georgia	1		11	93		13	3
Florida	1	2		93			10
East South Central	**5**	**2**	**21**	**192**	**3**	**80**	**25**
Kentucky			1	55	1	1	2
Tennessee	2	2		53	1		2
Alabama	2			69	1	17	18
Mississippi	1		20	15		62	3
West South Central	**7**	**1**	**31**	**987**	**7**	**222**	**61**
Arkansas	1		9	107		15	2
Louisiana	1		5	13	1	62	13
Oklahoma	2		17	88	1	22	13
Texas	3	1		779	5	123	33
Mountain	**4**		**344**	**547**	**1**	**64**	**13**
Montana			12	94		1	
Idaho				40			
Wyoming				53		3	
Colorado			270	50	1	14	3
New Mexico	1		5	44		26	6
Arizona	3		57	177		20	4
Utah				89			
Nevada							
Pacific	**3**	**1**	**24**	**2,003**	**5**	**42**	**31**
Washington			6	310		2	
Oregon	1		6	339		18	3
California	2	1	12	1,354	5	22	28
Alaska							
Hawaii			6	47			

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended June 23, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [1] (040,041)	Whooping cough (056)	Rabies in animals
United States	16	914	1	17	57	1297	148
New England		91			4	43	
Maine		7				6	
New Hampshire		[2] 2				3	
Vermont		2				1	
Massachusetts		59			4	21	
Rhode Island		7					
Connecticut		14				12	
Middle Atlantic	2	223			11	121	6
New York		[2] 126			3	50	4
New Jersey	1	40				33	
Pennsylvania	1	57			8	38	2
East North Central	1	280		3	6	182	24
Ohio		81				33	1
Indiana	1	5			1	31	15
Illinois		40		3	3	17	4
Michigan		134			2	43	4
Wisconsin		20				58	
West North Central		32	1	3	1	76	41
Minnesota		7				10	1
Iowa		8				11	14
Missouri		10	1	3	1	12	23
North Dakota		2				19	
South Dakota		1				3	
Nebraska		1				1	
Kansas		3				20	3
South Atlantic	9	49			8	157	17
Delaware		1				1	
Maryland	3	13				6	
District of Columbia		3				6	
Virginia	4	3			1	43	8
West Virginia		4			2		
North Carolina	1	17				56	
South Carolina	1					1	5
Georgia		3			5	33	4
Florida		[2] 5				11	
East South Central		23		1	8	124	30
Kentucky		1			1	71	14
Tennessee		10				22	8
Alabama		5			6	20	6
Mississippi		7		1	1	11	2
West South Central		15		8	7	399	29
Arkansas				4	1	33	5
Louisiana		2		1	4	2	
Oklahoma		2		2		37	3
Texas		11		1	2	327	21
Mountain	3	26		2	2	117	
Montana		1				11	
Idaho	1	1				7	
Wyoming	1					5	
Colorado	1	4			1	19	
New Mexico		4				24	
Arizona		3			1	43	
Utah		[2] 13		2		8	
Nevada							
Pacific	1	175			10	78	1
Washington		11				9	
Oregon	1	7				8	
California		[2] 157			10	61	1
Alaska							
Hawaii							

[1] Including cases reported as salmonellosis. [2] Including cases reported as streptococcal sore throat.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended June 9, 1951

Disease	Total	New-found-land	Prince Ed-ward Island	Nova Scotia	New Bruns-wick	Que-bec	On-tario	Mani-toba	Sas-katch-ewan	Al-berta	Brit-ish Co-lum-bia
Brucellosis	3					1	2				
Chickenpox	1,331	2		45	8	167	780	46	26	77	180
Diphtheria	1					1					
Dysentery, bacillary	3					1	2				
Encephalitis, infectious	3					1			2		
German measles	354			5		39	203		15	32	60
Influenza	20			10	2		2	2			4
Measles	1,587	4		148	2	445	359	37	30	347	215
Meningitis, meningococcal	2	1				1					
Mumps	660	1		35		131	165	26	68	57	177
Poliomyelitis	2						1		1		
Scarlet fever	399	5			1	108	53	36	7	61	128
Tuberculosis (all forms)	215				15	85	36	17	10	18	34
Typhoid and paratyphoid fever	12					4			2	1	5
Venereal diseases:											
Gonorrhea	279	7		7	4	86	45	17	14	35	64
Syphilis	106	1		5	2	61	15	3	8	4	7
Primary	8			1	1	3		1	2		
Secondary	4					4					
Other	94	1		4	1	54	15	2	6	4	7
Whooping cough	128	2				18	50	2	3	19	34

MADAGASCAR

Reported Cases of Certain Diseases and Deaths—April 1951

Disease	Aliens		Natives	
	Cases	Deaths	Cases	Deaths
Bilharziasis			32	
Diphtheria	5	2	12	3
Dysentery:				
Amebic	2		58	1
Bacillary	2		9	
Erysipelas			3	
Influenza	103		8,425	17
Leprosy			17	
Malaria	136	3	23,418	76
Measles	8		84	
Mumps	2		158	
Paratyphoid fever			5	
Plague			18	11
Pneumonia (all forms)	9		374	37
Puerperal infection			4	
Tuberculosis, respiratory	11	2	59	14
Typhoid fever	4		6	
Whooping cough	5		358	10

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently. A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Cholera

India (French). A sharp increase in the incidence of cholera was noted for the week ended June 2, 1951, when 19 cases (5 deaths) were reported compared with 2 for the previous week. During April and May only 4 cases were reported.

Pakistan. During the first 3 weeks of May the incidence of cholera was decreasing. For the week ended May 19, 1951, 534 cases were reported which was less than half the number (1,201) reported for the week ended April 28.

Plague

Brazil. During March four cases (three deaths) of plague were reported in Pacoti County, Ceara State.

Indochina. Two cases each of plague were reported in Baria and Phanthiet, Viet Nam, during the week ended June 9, 1951.

Smallpox

Belgian Congo. During the week ended June 2, 1951, 67 cases of smallpox were reported. Of these, 55 were in Stanleyville Province. For the previous week 17 cases were reported of which 11 occurred in Stanleyville Province.

Korea. Smallpox in Korea seems to be on the decrease. From 153 cases reported in March the incidence declined to 126 for April. However, in the port of Yeosoo where no cases were reported during March, there were 109 cases in April.

Yellow Fever

Gold Coast. One fatal suspected case of yellow fever was reported on May 29, 1951, in Swedru.

AGING, a New Bulletin

Establishment of a new bulletin, AGING, devoted to the field of geriatrics, was announced by the Federal Security Agency during July. According to Clark Tibbitts, Chairman of the Federal Security Agency's Committee on Aging and Geriatrics, AGING will not be issued on any regular schedule.

Requests for copies of the first and subsequent issues should be addressed to the Office of Publications and Reports, Federal Security Agency, Washington 25, D. C.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work. Articles of special interest are issued as reprints or as supplements, in which forms they are made available for more economical and general distribution.

Requests for and communications regarding the PUBLIC HEALTH REPORTS, reprints, or supplements should be addressed to the Surgeon General, Public Health Service, Washington 25, D. C. Subscribers should remit direct to the Superintendent of Documents, Washington 25, D. C.

Librarians and others should preserve their copies for binding, as the Public Health Service is unable to supply the general demand for bound copies. Indexes will be supplied upon request.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price per year—$4.75, domestic; $6.25, foreign.

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PUBLIC HEALTH SERVICE

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Public Health Reports

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Public Health Problems in Alaska

The diverse and often unique natural features of the Territory of Alaska, and the importance of its invaluable natural resources in view of increasing world problems, created the need for evaluating the current status of Alaskan research. As a result, the first comprehensive Alaskan Science Conference was held in Washington, D. C., November 9 to 11, 1950, under the auspices of the National Academy of Science-National Research Council.

The objectives of the conference, as stated in the published proceedings, were "to stimulate wider interest in research relating to the Alaskan area and to explore ways and means by which those who are engaged in field research in Alaska can be of greater assistance to each other and by which the results of their investigations may become more widely known and available to those who are planning future research in Alaska."

The conference suggested means of achieving these objectives: (1) To review the status of scientific research in Alaska; (2) to appraise the major requirements for future research; and (3) to explore ways and means of developing new facilities and coordinating the existing ones.

As a permanent organization in Alaska, with a resident staff devoting full time to basic research on health and related biological problems, the Arctic Health Research Center sought to provide current information for scientists who had conducted earlier investigations in Alaska on an expeditionary basis. Staff members of the Center hoped, as well, to provide orientation for those individuals contemplating future research in Alaska.

The presentation of formal papers by members of the Alaska Health Research Center staff in the conference sections of Public Health and Medicine, Physiology, Health Problems of Alaskan Eskimos, Aleuts, and Indians, and Research Facilities in Alaska, constituted the Center's major tangible contribution to the conference. Abstracts of the papers have appeared in the Proceedings of the Alaskan Science Conference, Bulletin of the National Research Council, No. 122, April 1951. The complete papers are presented in this issue of PUBLIC HEALTH REPORTS.

Problems of Alaskan Eskimos, Indians, Aleuts

By **Jack C. Haldeman, M.D.,** *Medical Officer in Charge*

In this brief review of public health problems in Alaska, I will necessarily have to confine my remarks to some of the more important problems which confront us. Perhaps the greatest value of the Alaskan Science Conference lies in pointing out some of the many gaps in our scientific knowledge with the hope that ways will be suggested in which the various scientific groups may cooperate. Acquisition of needed information requires the concentrated and coordinated efforts of scientists skilled in many fields. I regret that time does not permit specific reference to the many contributions to public health in low temperature areas which have been and are being made by these investigators.

Any attempt to analyze public health problems in Alaska is handicapped from the start by the lack of reliable vital records. Despite their limitations, however, such data as are available may be utilized as indications of general trends.

The evidence from existing records, even allowing for a margin of error, points to causes of death, and therefore to conditions of life in low temperature areas, which show quite different patterns than are found in temperate climates. One may expect to find in low temperature areas almost all the diseases found elsewhere, except those peculiar to the Tropics. However, the incidence, the methods of transmission, the epidemiological patterns, as well as the clinical picture of disease in low temperature areas all show distinctly different characteristics.

According to available data, diseases spread through the respiratory tract are among the major health problems of the Eskimo, Aleut, and Indian. These diseases account for approximately 50 percent of all deaths among this population group.

Tuberculosis is the major killer in Alaska. In 1946, it was reported as the cause of death on 43 percent of all death certificates for Indians, Eskimos, and Aleuts in Alaska, more than 10 times as often as in the United States as a whole. Of the approximately 130,000 people in Alaska, more than 5,600 are listed in the tuberculosis register of the Department of Health as actual or suspected cases of tuberculosis. In addition, there are more cases of bone tuberculosis under one roof in the Orthopedic Hospital near Sitka, Alaska, than in any other spot on the North American Continent.

Communicable Disease Epidemics Severe

The dramatic and terrifying nature of epidemics of common com-

municable diseases has been noted by many observers in their historical accounts of early explorations. In 1938, I observed a whooping cough outbreak in the lower Kuskokwim delta area which affected literally every man, woman, and child in many villages. A measles epidemic along the Yukon River impressed me with its severity and the high proportion of adults affected. Within the last month a whooping cough outbreak at Wainwright, an Eskimo village of approximately 150 inhabitants, resulted in nine deaths. As this paper was being prepared, epidemics of poliomyelitis, meningococcus meningitis, typhoid fever, and whooping cough were present in the Territory.

It is somewhat paradoxical that the low temperature areas of the world, although they contain the fewest people per square mile, are plagued with those major health problems usually associated with overcrowded living conditions. Even in the spacious North it is not uncommon for an Eskimo family of 12 to be living in a single 9- by 9-foot hut in order to conserve heat. The attack rate of diseases spread directly from person to person is understandably high under such conditions, whether the population sample is taken from the slums of a Stateside metropolis or from an Eskimo village.

Diseases spread chiefly through discharges of the intestinal tract, although less frequently reported as the immediate cause of death, represent a major cause of morbidity in Alaska.

Outbreaks of gastroenteric diseases are frequent, particularly in the spring when the melting ice and snow expose and redistribute the well-preserved refuse of the long winter months. A diverse group of pathogenic organisms has been isolated during these outbreaks, but relatively little is known regarding the effects of low temperatures on the epidemiology of these diseases or on the morphological, biochemical, and pathogenic characteristics of the individual causal agents.

It would appear that the incidence of syphilis is lower in Alaska than was previously thought. However, morbidity reports of the Alaska Department of Health indicate that once syphilis is introduced into a village, it frequently assumes epidemic proportions.

Other papers will review the public health importance of broad fish tapeworm infection, hydatid disease, trichinosis, and phlyctenular keratoconjunctivitis. Additional public health problems are presented by the existence in the Territory of tularemia, botulism, brucellosis, and rabies.

The unusual epidemiological pattern of communicable diseases in Alaska, coupled with the relatively simple and stable background of the Eskimo people, offers the investigator interested in the natural history of disease an unusual opportunity for study and original research.

Two other major health problems in Alaska, aside from the communicable diseases, are accidents and nutritional deficiencies.

Accidents Take High Toll

A preliminary analysis of records of violent and accidental deaths in Alaska indicates some fruitful areas for study by anthropologists, sociologists, and public health workers. Accidents, alcoholism, suicides, and homicides, as a group, accounted for 32 percent of the deaths among the white population and 13 percent among the nonwhite population during the 5-year period ending in December 1949. By comparison, in 1948, only 9 percent of all deaths in the United States as a whole were attributed to these causes.

Aircraft accidents were the major cause of accidental death in Alaska; accidental drownings ranked second, and fires and burns third. Excessive cold, which might be expected to rank high as a cause of fatalities, is of minor importance among both white and nonwhite residents.

Alcoholism was reported as the immediate cause of death among the white population 20 times as often in Alaska as in the States, and 8 times as often among the nonwhite group.

There is much food for thought, and a challenge for some investigator, in the fact that deaths by suicide occurred three times as often among white residents in Alaska as in the States; yet among other races the suicide rate appeared to be lower than in the States. On the other hand, it may surprise some of you to learn that in Alaska, where practically everyone uses and has ready access to firearms, the homicide rate was only twice that of the States.

Nutritional Status Unknown

Turning for a moment to nutrition, we find that dietary habits differ greatly in various areas of Alaska.

From the point of view of diet, there may be said to be three different population groups in the Territory: (1) The group composed largely of Indians, Aleuts, and Eskimos, who, by reason of custom or isolation and necessity, still eat primarily native foods; (2) a larger group who supplement native foods with considerable amounts of food imported from the States; and (3) the remainder of the Alaskan population, including some Indians, Aleuts, and Eskimos, who depend almost entirely on imported foods for their nutritional requirements.

The true nutritional status of the first group is essentially an unknown quantity, since little information is available on the composition of the foods which its members customarily eat. One can only speculate, therefore, on the possible relation of this particular diet to such factors as: (1) Any increase or decrease in the size of the Indian and Eskimo populations; (2) the physical stature and develop-

ment of the individuals included in this group; and (3) the incidence of disease such as tuberculosis, heart disease, eye conditions, anemia, and dental caries among its members.

A considerable proportion of Indians and Eskimos belong to the second group, a large part of their diet being composed of imported foods. Because of low incomes and the relatively high cost of imported foods, their diets contain a high proportion of foods which represent a cheap source of calories, such as refined cereals and sugars. The nutritional picture of this group, insofar as it is known, is not an encouraging one. The actual nutritional status of its members has not been sufficiently well determined, however, to indicate in what specific ways it can be improved.

Basic Issues Untouched

The question of major causes of nonfatal illness in Alaska can only be answered after further study. At present, we cannot give a factual answer even to the frequent query, "Are colds more common in low-temperature areas than in temperate climates?" There is a definite need for a relatively large-scale morbidity survey in Alaska, taking into account the geographic, ethnologic, and economic characteristics of the Territory and covering a cross section of the population large enough to yield reliable results.

Over and above specific problems, such as disease control, accidental deaths, and nutritional needs, there are many basic issues affecting the health of the Eskimos, Indians, and Aleuts upon which we have not touched. The relation of man to his physical environment in low-temperature areas has been the subject of considerable discussion at this conference. Man cannot adopt the physiological techniques of arctic animals which make them relatively independent of temperature. But he can and does create a favorable environment for himself through the provision of suitable clothing, housing, sanitary facilities, and the control of biting insects. Much has been learned and much remains to be learned from the Alaskan Eskimo and Indian regarding practical methods of overcoming adverse environmental influences. They have generally ignored the provision of sanitary facilities and such measures as insect control. Even if insect control were not of public health importance, it would be regarded as essential to civilized living by white residents.

Little scientific information is available concerning basic differences in racial pathology among the white, Indian, Eskimo, and Aleut populations. For example, we have no way of knowing whether the high tuberculosis mortality rate among the latter groups should be attributed simply to a higher degree of racial susceptibility or to a combination of factors, such as exposure to massive doses of tubercle bacilli in crowded living conditions, poor nutrition, recurrent gastro-

enteric diseases, and parasitism. What diseases existed among the Eskimos and Indians prior to the coming of the white man? It would seem that here are but a few of the areas where the public health worker and the anthropologist could cooperate in worth-while research.

The administrative development of public health practices in temperate climates has resulted in a fairly uniform pattern based upon the concept of local health services provided by full-time well-trained public health workers. Health services in temperate areas generally utilize techniques in the control of disease best suited for application where there are concentrations of people and emphasize those public health problems of greatest importance in temperate climates. In low temperature areas, however, the public health problems are radically different; social, geographic, and climatic factors make the application of conventional public health techniques difficult and often impractical. The development of new techniques in public health administrative practice more suitable to the area involved is urgently needed.

Unique Research Opportunity

In the course of this discussion, an attémpt has been made to indicate broad areas where basic information is lacking, and where research and investigation in the fields of public health and medicine is most urgently needed. However, I would be neglecting my duty if I did not stress the special advantage of Alaskan research as a means of enriching scientific knowledge which should be equally applicable in all climates and to all races. The extreme variations in health problems and environmental factors in low temperature areas permit scientific measurements which bring into sharp relief many basic facts less readily observable in more temperate climates.

Where could the investigator find a better opportunity for conducting long-term studies on the relation of high-fat diet to chronic diseases than among Eskimo groups subsisting principally on Arctic Sea mammals? In what other area can communities be found where dental caries is practically unknown, while adjacent settlements show an extremely high incidence of the disease?

Circumpolar Aspect of Disease

The concept that many animals and plants are commonly distributed throughout polar regions has been recognized in biology for many years. However, the application of the concept of circumpolar distribution to disease and health problems has been slow in evolving. Since the polar area is bounded by the more or less contiguous land masses of three continents—North America, Asia and Europe—it is possible that, through the ages, diseases may have traveled from vil-

lage to village in Northern Europe, across Asia to Alaska and Canada in much the same fashion as have the circumpolar animals and plants. The barriers which the Atlantic and Pacific oceans have presented to the transmission of disease in temperate areas have not existed in the Arctic.

In all polar areas there are also basic similarities in the relationships of man to his environment. From the standpoint of public health, perhaps the most important of these are: (1) the crowded living conditions; (2) the generally primitive state of sanitary facilities; (3) the intimate relations of arctic people with their own forms of domesticated animals and other animal and insect vectors of disease; and (4) the similarity of social patterns among native inhabitants of the Arctic. For these reasons, it will not be surprising if, as a result of future investigations, the medical and public health problems of low temperature areas present a more uniform picture than that seen in temperate and tropical climates.

It has been repeatedly pointed out that low temperature areas are destined to play an increasingly important role in our national economy and defense. It is our job, therefore, to gather the scientific information needed to bring true knowledge of these areas into sharp focus as rapidly as possible. It is only logical that research and investigation should precede, insofar as possible, the forced economic development of low temperature areas in order that there will be a minimum of waste in time, effort, and money and in order that the most effective use will be made of the human and other resources in these areas.

Control of Alaskan Biting Insects

By Charles S. Wilson, ***Control Entomologist***

In many parts of Alaska, outdoor insect control is so necessary for civilized living that the small home builder may be as willing to pay 50 to 100 dollars for spray equipment as he is to buy a kitchen sink. It is small children who suffer most. After the long confinement of the winter, they will not stay inside and look at the summer sunshine through a cabin window, and they will not play wearing gloves and head net or smeared with repellent that burns the eyes and lips.

The monetary costs and total time lost because of biting insects in Alaska can only be roughly estimated, but many contractors believe that they are considerable. Umiat affords an extreme example but one fairly typical of conditions on the Arctic Slope. In Umiat

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where wells are being drilled, tractors overhauled, and the other activities of a base camp are being carried on, Blanton counted mosquitoes landing at the rate of 70 per minute on the back of a woolen glove (*1*). Such attack rates are particularly important in northern areas where maximum insect activity occurs during the only periods when many kinds of outdoor work are possible.

Neither Umiat nor any other single place is typical of all Alaska. A map of the Territory placed on a map of the United States of similar scale, extends from the Atlantic to the Pacific coast and from almost the northern to the southern borders. When it is considered that this great, sprawling Territory includes four large mountain ranges and that its precipitation varies in different regions from a few inches to 17 feet annually, it does not seem unreasonable to expect to find nearly as many types of environments as there are in the whole of the United States. Much of this country is undeveloped and presents no immediate demand for insect control, but wide distribution of human activities, from Point Barrow to Ketchikan, presents so many problems in insect control that careful selection must be made among them.

Alaska Insect Project

There was a surprisingly good background of information available when the entomology section of the Arctic Health Research Center was organized in 1949, even though organized and sustained research had not started until 2 years before that time. Part of this information resulted from the Navy work at Umiat (*2*), but most of it came from the investigations of the Alaska insect project (*3*). This cooperative project, supported by the armed services and governmental agencies concerned with development of Alaska, was started in 1947 and has operated each season since then. Under the direction of Dr. Travis, its roster has, at one time or another, included the names of many of the men who are important in work on biting insects. In fact, most of the entomologists of the Arctic Health Research Center received their first Alaskan experience with the insect project.

It is not possible to summarize here all of the information that was available in the spring of 1949. The important insects were then considered to be mosquitoes, black flies, punkies or no-see-'ums, and horseflies. Reconnaissance studies by Dr. Frohne of our staff have since shown that snipe flies should be added to the list as close competitors with the punkies and of more importance than horseflies. The latter are slow biters, chiefly important as pests of livestock and as possible transmitters of tularemia.

There are so many gaps in our knowledge of the black flies, punkies, and snipe flies that it is difficult to make generalizations about their control. In many places the black flies are more hated than mosqui-

toes. The reactions of many people to their bites are more severe and are sometimes disabling. DDT is very effective in clearing the larvae from the streams, but it has not been used because of the danger to fish and to fish food. The studies of the Alaska mosquito project and of Mr. Sleeper of our staff indicate that a safe but effective dosage level exists. Development of field methods for applications within that narrow margin is to be started next season. The punkies at Valdez were found by Dr. Williams, also of our staff, to breed only in a narrow strip of sedge that is covered daily by high tides. We plan to attack this species by using herbicides on their plant cover, but we doubt that this method will be effective on other and more widely distributed species that probably breed in bogs. The larvae and breeding places of the snipe flies are still unknown, so control measures must be directed against the adults.

Wide Range in Conditions

For convenience, we usually divide Alaska into six regions when discussing the problems of insect control. Two of these, the Aleutian Chain and the high mountains, need little attention. Each of the other four has a fairly distinct set of problems and conditions. Southeastern Alaska is a country of isolated settlements and small but varied environments. It has nearly all of the pest species that occur in the Territory, but their breeding places are usually so restricted that specialized methods of control could be economically used if adequate surveys were available.

The Cook Inlet country, which includes Anchorage, the Matanuska Valley, and part of the Kenai Peninsula, is a sort of middle ground in which the environments are larger and less varied than in southeastern Alaska but much more varied than they are in the interior. Part of this region is fairly well populated, allowing use of control measures that would not be economically feasible in the southeast. Single large-scale mosquito larvicide applications can probably be used to advantage near Anchorage and in the Matanuska Valley when the necessary surveys have been made and the organizations developed for their application.

It is in the great interior valleys that one begins to find what mosquito infestations can be. Black flies and punkies are present in many places, but they are likely to go unnoticed among the mosquitoes. Since mosquitoes breed nearly everywhere, reinvasion of an area cleared by destruction of adults or larvae may be expected from all sides. That they migrate at very high speeds was dramatically shown by Blanton's experience while working with 100-square-mile blocks. Invasion to the center occurred within 3 days of the first heavy emergence in outside areas and within 2 weeks after the adults were killed on the same large block later in the season.

Military Area Control

Area control is being used, however, as a practical routine procedure for the protection of the large military bases. The technique was brought to its present high degree of development by the work of the Alaska insect project (*4*). Each season, a spray team is designated by the Alaska Command and a C–47 is equipped for its exclusive use. Blocks of 25 to 35 square miles, centered on the areas to be protected, are sprayed at intervals of 7 to 10 days, three to seven treatments being required for the season. The rate of application is one-half pint of 20 percent DDT per acre, the swath width is 1,000 feet and the mass mean diameter is given as 136 microns. Obviously, a program such as this can only be used where many people are living in a small area and where the necessary organization has been established. Area spraying has also been tried on the Arctic Slope and rejected as impractical. The pressure of insect population is so great and migration is so rapid in that region that reinvasion is likely to take place within a few hours after spraying.

Factors in Mosquito Control

The significant factors that distinguish Alaskan mosquito control may be summarized as follows:

1. The important mosquitoes may be considered to produce but one brood each year although successive thawing of pools and successive maturation of species may extend the season.
2. The classical method of mosquito control by drainage is ineffective in the interior where the pools are underlaid with ice and impractical in the dense growth of the southeastern coast.
3. Even though there is but one brood per year, the combination of long-flight range and great pressure of insect population makes it impossible, in the interior valleys and on the Arctic Slope, to obtain control by a single treatment of an area of reasonable size.
4. Single treatments, probably by use of larvicides, may be effective in the regions of restricted breeding found in the mountains and near the coast. The greatest obstacle to the use of this type of control is the difficulty of making adequate surveys.

Develop Aerosol Spray Units

With drainage and larviciding practically eliminated from mosquito control practice at this time, the Arctic Health Research Center has concentrated on development of the use of fine airborne sprays for destruction of the adults. The first objective was to find methods for protection of small installations such as camps, lodges, and homesites. An aerosol spray apparatus was developed that consists essentially of a series of more or less stationary aerosol dispensers placed so as to allow the insecticide to drift over the areas to be protected (*5*).

The dispensers are operated by compressed air and are connected by hose lines to a compressor. The nozzles are of the simple "flit-gun" type but contain a special feature that causes them to produce droplets of very nearly the optimum size range, 2 to 40 microns in diameter.

The units can usually be set up at a cost of between 50 and 100 dollars. They have found rather wide acceptance among the groups for which they were intended and modifications have been used in other situations. Towns, contractors, and large road camps often have mobile air compressors to operate jack-hammers. Multiple nozzles of the type used on the aerosol dispensers are mounted on booms connected to these large air compressors, and available equipment is used to accomplish for $100 a job which would require $1,400 to $1,800 with commercial equipment.

Both the aerosol units and the spray booms depend on local destruction of adult insects and consequently require very little technical knowledge or community organization for their operation. The Arctic Health Research Center is continuing development of these nontechnical methods of control in a study of nozzles that will produce the necessary small droplets with a minimum use of air or other force. As a supplementary study, we are starting development of spray equipment that will be suitable for use by the bush pilots of Alaska.

Work With Small Plane Equipment

The reasoning behind our work on the airplane equipment is as follows:

1. The military spray team is getting very good results with one-half pint of 20 percent DDT per acre, applied in 1,000-foot swaths and with an m. m. d. of 136 microns.

2. It is only the airborne droplets that are effective for destruction of adult flying insects. Sixty-micron droplets falling 20 feet per minute, for example, are unlikely to strike many mosquitoes when the plane is flying 1,000-foot swaths.

3. Calibrations indicate that less than 2 percent of the solution being sprayed in the present program is in droplets of aerosol sizes.

4. The low sun of the northern summer "nights" provides many hours of almost ideal spraying conditions so that fine sprays can be effectively utilized.

Dispersion of practically all of the insecticide solution in 2- to 40-micron droplets should permit a great reduction in the rate of application and a great increase in effective swath width. Released from the limitations of small pay load and narrow swath width, small planes would become practical for mosquito control. Utilization of locally based planes should, by allowing more frequent spraying, permit the treatment of smaller areas and secure better timing.

Any local spraying done by bush pilots will have to be incidental to their other work. The short insect season and the volume of the business will not permit a high degree of specialization. Consequently, we are attempting to test and develop spray equipment suitable for the monoplanes now in use. In order to be acceptable, this spray equipment must not only deliver between 1 and 2 gallons per minute in aerosol-size droplets, but it must also be so quickly and completely demountable as to allow the pilot to spray at night and fly a clean and unencumbered plane in the morning. Even slight interference with performance of the airplane is objectionable in Alaska where there is a high premium on pay load and danger of icing on over-mountain trips.

The active interest of the local operators will be utilized in development of designs for removable tanks and fittings that are suitable for as many as possible of the local types of airplanes. The Arctic Health Research Center will undertake the testing and design of nozzles, development of spraying techniques, and determination of the range of practical application. A small wind tunnel is being built for use in preliminary studies of nozzle performance and for determination of droplet size without the errors that occur in outdoor settling of aerosol sprays. An airplane is to be chartered in the spring and used for surveys and preliminary tests of field methods for black fly control, as well as for testing equipment and spraying techniques.

REFERENCES

(*1*) Blanton, F. S., Travis, B. V., Smith, Nelson, and Husman, C. N.: Control of adult mosquitoes in Alaska with aerial sprays. J. Econ. Ent. **43**: 347–350 (1950).

(*2*) Jachowski, Leo A., Jr., and Schultz, Carlos: Notes on the biology and control of mosquitoes at Umiat, Alaska. Mosquito News **8**: 155–165 (1948).

(*3*) Progress Report of the Alaska Insect Control Project for 1947: Interim Report No. 0–128; ibid. 1948: Interim Report No. 0–137; ibid. 1949: Interim Report No. 0–139.

(*4*) Blanton, F. S., Husman, C. N., Travis, B. V., and Wilson, C. S.: Control of Alaskan mosquito adults by aerial sprays. J. Econ. Ent. **42**: 106–109 (1949).

(*5*) Wilson, Charles S.: Aerosol spray units for control of biting insects. Mosquito News, **10**: 51–54 (1950).

Sewage and Waste Disposal Problems

By E. K. Day, ***Senior Sanitary Engineer***

Low temperatures and the resulting conditions are the principal factors which distinguish the problem of sewage and waste disposal in arctic and subarctic areas from the same problem in temperate

climates. Biological and chemical reactions are retarded and physical changes occur in the environment, all of which must be taken into consideration in the design and operation of facilities for the collection, treatment, and disposal of sewage and other wastes.

The principal reason for emphasizing proper treatment and disposal of sewage and wastes in any area, regardless of temperature variations, is, of course, for the prevention of disease transmission. Although the epidemiological picture is not sufficiently complete to show the direct relationship of specific outbreaks of enteric infections in the arctic and subarctic to improper methods of sewage and waste disposal, it is logical to assume that they play essentially the same role as in temperate climates. This conclusion can be strongly supported by the incidence and distribution of such infections in low temperature areas.

Space will not permit detailed coverage of all the problems involved in sewage and waste disposal in low temperature areas. Since both community and single premise systems present major problems, each will be discussed with emphasis only on those factors which appear to be most significant in the Alaskan situation.

To date, the design and construction of a workable and economically feasible sewage collection system has been one of the major problems of community sewage disposal in permafrost areas. Population increases in recent years are making apparent the need of investigative work on treatment processes and rates of recovery of arctic streams. The essential problem in single premise sewage disposal is the final disposition of the waste materials.

Community Systems Studied

In the light of our present knowledge, we believe that the solutions of most of the problems involved in community sewage collection systems depend largely and simply on the application of known engineering principles to modify conventional design and operating practices. This conclusion is supported by the successful operation of at least one system in the permafrost area of Canada and by the results of careful analysis of the difficulties experienced in the operation of the one existing system in the permafrost area of Alaska at Fairbanks. Although it is a near perfect example of how not to build a sewage collection system for operation in low temperature areas, the Fairbanks system has proved very useful for study of trouble spots. Data obtained on this system will be used as a basis for discussion of some of the factors which appear most significant in relation to operating a conventional collection system in a low temperature area. First hand observations to date indicate that the most important factors involved in preventing freezing in collection systems are depth of

cover, rate of flow, and grade of sewer line, all capable of control by good engineering.

Ground temperature studies indicate that throughout much of the permafrost area, at depths of 8 feet or more, temperatures do not vary greatly throughout the year and fall only a few degrees below freezing. Careful observations made over the period of a year on the Fairbanks system indicate the significance of heat losses from the sewers on frost penetration. Temperatures adjacent to the sewers were found to be only slightly below freezing even at depths of 5 feet or less.

Many laterals in the Fairbanks system have no more than 5 feet of cover and some have 4 feet or less. There is every reason to believe that an increase of cover to a minimum of 8 feet or more would result in a considerable decrease in the temperature differential between the sewage and the soil surrounding the sewer lines which, in turn, would result in decreased heat losses and less likelihood of freezing.

There are 105 dead-end laterals in less than 14 miles of sewers in the Fairbanks system. In many cases there are no more than four or five contributors and sometimes less to a line. This condition, together with lack of a water distribution system and inadequate private water supplies, results in little or no flow at times. The reason for freezing difficulties under these circumstances is obvious.

The majority of grades checked during maintenance work by the city furnish velocities of 1 to 1.5 feet per second in 6-inch pipe, with other grades running less. These are somewhat below the recommended velocities of 2 to 3 feet per second and do not provide the necessary self-cleansing action. As a result, deposits accumulate in the lines, flows are retarded, and freezing is promoted.

Ground temperatures and other pertinent data have been obtained including (1) sewage temperature; (2) temperature of air in the lines; (3) outside air temperature; (4) analyses of soils at test points; (5) characteristics of sewer lines; and (6) information concerning contributing population.

Many other factors will, of course, need careful investigation, including the relative suitability of various types of pipe with relation to transmission of heat and resistance to damage by freezing, effect of soil compaction, location of lines to take advantage of snow cover, loss of heat through manholes and house vents, effect of turbulent flow on heat losses from sewage, and so on.

Utilidors, although successfully operated in military and other government installations, do not appear to be economically feasible for less compact communities or residential areas in Alaska. Costs per linear foot of various types of concrete utilidors, based on United States prices but not including utilities, were estimated from $35.30

to $40.70 by Hyland and Mellish in 1948. Based on a cost factor of 3, which was valid in May 1948, in the Fairbanks and Nome areas but which has since increased, costs would range from $105.90 to $122.10 per linear foot, or from $5,295 to $6,105 in all, for constructing such a system for 50-foot lot.

In addition to economic disadvantages, there are obvious health hazards involved in having sewer lines and water lines in the same enclosed system. That utilidors serve as an ideal nesting place for rats, permitting easy access between buildings, has also been pointed out.

Treatment Processes Adaptable

At present, treatment of sewage does not constitute a critical problem in Alaska. As populations increase, however, the discharge of raw sewage into natural water courses will become a more significant health problem. Thus, the need for investigative work to provide a basis for design of treatment facilities suitable for low temperature operation becomes apparent. Primary treatment will probably be adequate in most of Alaska for some time because of relatively small concentrations of population and the availability of large bodies of water for final disposal. Therefore, applicability of primary treatment processes, including sedimentation and sludge digestion and disposal, should be given priority in the investigative program.

The common treatment processes all appear capable of adaptation to arctic and subarctic use. The optimum temperatures for most treatment processes are relatively high as compared with temperatures at which sewage could be expected to reach treatment facilities in arctic and subarctic areas. The problem in these areas, therefore, resolves itself to one of economics, involving a comparison of the cost of adding and conserving heat and the cost of constructing treatment facilities to operate at less efficiency.

Rates of biochemical stabilization and bacterial die-away rates in arctic streams may have considerable bearing on the degree of treatment necessary in some cases. Studies are needed to determine the effects of such factors as heavy ice cover during much of the year, effect of heavy loads of silt and organic matter, and the effect of heavy pollution loads due to thawing of winter accumulation during the spring breakups.

Single Premise Methods

Single premise disposal methods are important in Alaska since it is estimated that approximately 75 percent of the 130,000 people in Alaska are still dependent on single premise methods of sewage disposal. With some modifications, most of the common methods used in the temperate climates have been used in Alaska. However,

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their effectiveness and safety are sometimes impaired by the effects of low temperature on the chemical and biological processes and on the physical state of materials involved.

Although there are many aspects of the problem, involving esthetics, economics, and physical comfort, as well as public health, the greatest problem appears to be that of satisfactory final disposal. The usual methods of subsurface disposal, including conventional disposal fields, seepage pits, or cesspools, are not generally suitable in areas underlain with permafrost, especially if the active layer is relatively thin. Adequate leaching action cannot be obtained and the entire system is likely to freeze during the winter. The formation of frost mounds, a result of freezing of entrapped water, is an indication of what is likely to occur when subsurface disposal of wastes is attempted. This, in many cases, precludes the use of a water carriage system.

Pit and surface privies are not satisfactory in permafrost areas. Leaching action does not occur because of the frozen ground. During the summer the pits are likely to be filled with water, and in the winter all deposits remain frozen. In addition to the sanitation hazards involved, lack of heat and the resulting physical discomfort makes the use of privies impractical.

Because of the economics as well as the technical problems involved, the box-and-can system, or modifications thereof, is, at present, the most common method of sewage disposal for single dwellings in the Alaskan Arctic. Although not particularly desirable from the esthetic standpoint, it is probably the most practical system for isolated single dwellings and small villages in the permafrost area.

Final Disposal Big Problem

According to custom, a can or other receptacle is generally used within the dwelling and later dumped on the ground surface outside, usually close by, producing disagreeable and unhealthful conditions during the spring thaw. In some small communities, the receptacles are emptied into barrels or other containers and later hauled to some point outside the community and dumped on the ground surface. Frequently, the distance from the community is not sufficient to eliminate either the nuisance or the health hazard. In coastal communities the filled containers are placed on the ice during the winter to be carried away in the spring.

In the larger communities where the box-and-can system is used, scavenger services are usually provided, either by the municipality or by private operators. Frequency of collection varies from twice weekly to weekly, or at even longer intervals, the collection fee varying with the frequency of collection. After collection, the excreta is hauled to a relatively isolated spot outside the community and dumped. In coastal areas it is sometimes dumped on the beaches, and

tidal action is depended upon to wash it away. In one instance where this method was observed, the excreta were being dumped at a point at least 10 feet above high tide. Obviously, dumping on the ground surface or beaches, as practiced in nearly all instances where this system is used, is not desirable from the public health or esthetic standpoint.

Chemical toilets are not extensively used in Alaska. Their use as a modification of the box-and-can system would do much to eliminate the health hazard if not the nuisances which result from unsatisfactory disposal methods.

Incineration should be considered as a means of final disposal although the possibilities are greatly limited by lack of locally available fuel in much of the arctic area.

In those portions of the Territory which are not underlain with permafrost, the problem of single premise sewage disposal does not differ greatly from that in the colder areas of the United States. Septic tanks with subsurface disposal fields appear to present the best possibilities. However, prolonged periods of subfreezing temperatures with the resulting deep frost penetration necessitate special precautions to prevent freezing. The conventional subsurface disposal field has not been used and its limitations are not known.

Four experimental tanks have been installed at the University of Alaska, and observations will be made to study the effects of (1) siphon discharges; (2) snow cover; (3) soil compaction; and (4) traps to prevent heat losses through house stacks, as well as the need and economics of heating both tanks and disposal fields.

Industrial wastes, at the present time, do not constitute a major public health problem in Alaska. There are approximately 160 fish canneries, operating on a seasonal basis in the Territory, which constitute the major industrial waste problem. Generally, the wastes are deposited on the beaches or tide flats near the plants for removal by tidal action. Most of the canneries are located in relatively isolated areas, and almost without exception large volumes of water are available for dilution. Some local nuisances do occur. The development of the pulp industry in southeastern Alaska is significant mostly because of its possible effect on fish life.

Provision is made for the adequate control of receiving waters by the Alaska Water Pollution Control Act adopted by the Territorial legislature in 1949.

Garbage Disposal a Nuisance

Garbage disposal is generally unsatisfactory throughout the Territory. The usual method is by dumping and burning. Along the coast garbage is often dumped on beaches to be carried away by tide action. In the portions of Alaska where permafrost does not exist,

the garbage-disposal problem does not appear significantly different than in the colder areas of the United States.

In the permafrost areas incineration appears to offer the most promise. However, the cost of this method would be relatively high because of the small quantity of combustible material.

Grinding and disposal with sewage could be the solution in larger cities.

Summary and Conclusions

1. The public health significance of sewage and waste disposal in arctic and subarctic areas is essentially the same as in temperate climates.
2. The design and construction of economically feasible and workable sewage collection systems is still the major problem of arctic and subarctic areas, but can be solved by strict adherence to good engineering design practices.
3. Most of common sewage treatment methods are adaptable to use in arctic and subarctic areas.
4. The design of sewage collection and treatment facilities should consider the relative economy of the addition and conservation of heat beyond that necessary to prevent freezing and the construction of larger facilities to provide treatment at lower efficiencies.
5. Studies of arctic streams to determine rates of biochemical stabilization and bacterial die away are essential to determine the degree of treatment necessary.
6. Modification of the box-and-can system still shows the greatest promise for single premise disposal in permafrost areas, septic tanks with subsurface disposal in other areas.
7. Industrial wastes do not now constitute a major public health problem.

Biotic Interrelationships of Helminth Parasitism

By **Robert Rausch**, *Senior Assistant Scientist*

Biotic interrelationships in Alaska have so far suffered little from man's attempts to improve upon nature. As a result of these favorable circumstances, biological investigation in Alaska offers unusual opportunity for elucidating problems which can no longer be approached in the more populated parts of North America. One is very fortunate to have the opportunity of working under these conditions,

since present trends indicate that Alaska is soon to go by the way of the great wildernesses which once existed in the United States and Canada.

The following observations and conclusions are based upon the autopsies of more than 4,000 Alaskan birds and mammals, supplemented by field studies over much of the Territory. These observations are further substantiated by about 6,000 additional autopsies which I completed in the United States and Canada during the 8 years preceding the Alaskan work. This background work allows direct comparison of arctic conditions with those in warmer regions and contributes to the understanding of helminth parasitism in Alaska.

Parasites Found in Alaska

Certain general conclusions may be drawn in regard to occurrence of worm parasites in Alaska. It is evident that cestodes comprise the most abundant and varied group in both migratory and nonmigratory birds and, to a lesser degree, in mammals. Trematodes are relatively uncommon, particularly in arctic regions, although a few species occur commonly in marine mammals. We assume that the comparative lack of snail intermediate hosts, particularly in the more northern regions, contributes largely to this situation. One rarely finds these parasites even in such birds as loons and ducks, usually heavily infected with trematodes farther south. Strigeid trematodes are rare, although farther south, in the United States and southern Canada, they occur commonly in various aquatic and predatory birds. Parasitic nematodes are often numerically abundant, but the number of species is relatively small. In both arctic and subarctic regions, the diversity of species is much less than that found at lower latitudes. Certain genera are completely lacking, although they may comprise the major part of the helminth fauna of the same host farther south.

We have evidence that birds nesting in arctic regions, but wintering much farther south, are usually infected by cestodes while on the breeding grounds as nestlings or nonflying immatures. We have observed this especially among ducks and among other water birds such as gulls. Earlier observations on birds in the central and western United States support the conclusion that helminth infections are obtained essentially before migration takes place.

One of the factors which contributes to the interest of studies of this type in Alaska is the occurrence of a considerable number of mammals which are circumpolar in distribution. Comparisons can be made of the parasites of a given host on both continents, and this may lead to information of zoogeographical significance. As an example, some of the parasites of microtine rodents, such as *Heligmosomum costellatum* Dujardin, *Hymenolepis horrida* (von Linstow),

and *Paranoplocephala omphalodes* (Hermann), may be cited. These, with several other species, have been recovered from Alaskan voles and lemmings and are well-known Eurasian species, never having been reported from North America. Some earlier work in the Rockies (*5*) disclosed the presence of *H. horrida* and *H. costellatum* in voles in the subalpine zone. I have also recovered specimens of *H. horrida* from *Microtus ochrogaster* from the Great Smoky Mountains in Tennessee. This would seem to indicate that such parasites are relict forms, isolated in various southern mountain masses.

Although such parasites are found over much of Alaska, even in the lower, timbered country, they appear so far to have been unable to exceed the limitations of alpine and subalpine conditions farther south in the temperate regions of the continent. Observations to date indicate that *P. omphalodes* is limited to Arctic Alaska; however, it cannot be considered an arctic species, since it occurs southward well into Europe. This species may be a relatively recent invader from Eurasia and, so far, is limited to microtine rodents recently invading North America from the other continent—that is, *Microtus miurus* and other voles of the *Stenocranius* group, and *Microtus oeconomus* (*6*)—none of which has extended its range in North America beyond Alaska and northwestern Canada.

In microtine rodents and in many other mammals as well, we have collected helminths of species occurring farther south in Canada and the United States. However, we also have found several species which are new to the fauna of both North America and Eurasia (*2, 10, 13, 14, 15, 18, 19*). Some of these may occur in Siberia also, but this is unknown at present.

Survive Arctic Climate

The arctic climate does not necessarily have the effect on helminth parasites that one might expect, even though the complexity of their life cycles might lead to the conclusion that they would be vulnerable to climatic extremes. In fact, the evidence we have to date would indicate that many of the species occurring much farther south are able to exist very successfully under arctic conditions. For example, the tapeworms *Parnoplocephala infrequens* Douthitt and *Andrya primordialis* Douthitt occur commonly in the Arctic. We have taken the former, which has also been recorded from Siberian rodents, from as far north as Point Barrow, and we have specimens of the latter from Prince Patrick Island, north of latitude 75° N. Both species occur commonly over the United States. Other species found commonly much farther south, such as *Andrya macrocephala* Douthitt and *Syphacia obvelata* (Rudolphi), occur in Arctic and sub-Arctic Alaska, and in Siberia. We have recovered both species from as far south as Mexico City, where they occur in *Microtus mexicanus*.

Observations on the parasites of lemmings during the time of cyclic high population density (*9*) bear out earlier conclusions that, for microtine rodents, at least, there is no increase of worm parasites accompanying a great increase in host numbers (*12*).

Trichinosis in Marine Mammals

Some phases of the epizootiology of forms having much public health significance are not understood. It has been established that trichinosis is found in marine mammals, including the white whale and various seals, but the mode of transmission to them is completely unknown. The feeding habits of marine mammals, according to our present knowledge, would seem to preclude any opportunity for infection with *Trichinella spiralis*, since they are known to eat only fishes and various marine invertebrates, none of which can be infected with this parasite, as far as is known. We have thought that such animals might consume infected lemmings or other small rodents, which often gain entrance to the sea, particularly during times of cyclic high populations (*3*). Thus, the infection might be transmitted directly, or indirectly by the consumption of fishes which had fed upon infected lemmings. However, the examination of hundreds of such rodents has failed to disclose a single infection. It should be kept in mind, however, that a very small percentage of the population could be infected and still allow a considerable actual number of infected individuals. At times, lemmings reach such a high population density along the Arctic Coast that a few hundred would not be an adequate sample. We propose to study this situation more thoroughly during the next lemming high, expected during the spring of 1952.

It is possible that the strain of *Trichinella* found in the Arctic differs somewhat from that farther south in its ability to withstand low temperatures. We have no controlled observations on this as yet, but field observations would seem to bear out this impression. We expect to study the problem further this year, under both laboratory and natural conditions. Since much of the meat eaten by the Eskimos is first stored in cellars excavated from the permanently frozen soil, it seems desirable to determine the effect of such conditions on the survival of *Trichinella* larvae.

Trichinosis in the human population of Alaska represents a definite public health problem. Our observations so far seem to indicate that human infections may be contracted through the consumption of the flesh of marine mammals, which furnishes the bulk of meat consumed and is frequently eaten raw. Little pork or meat from other animals which might transmit trichinosis is available. The only carnivorous animals which might be involved would be the polar bear and the arctic grizzly (*Ursus richardsoni*), both of which are obtained from

time to time. It is the general custom of the Eskimos along the Arctic Coast to cook the flesh of bears.

The high prevalence of trichinosis infection in polar bears, as reported in the literature and on the basis of personal observations, would seem to support the hypothesis that they become infected from eating seals—their most important food source. The high prevalence seen also in land carnivores appears to be a direct result of natural predatory habits (*1*). Thorburg, Tulinius, and Roth (*17*) have discussed trichinosis in marine mammals in Greenland.

The Eskimos on Saint Lawrence Island depend almost exclusively upon the flesh of sea mammals for food, to a degree considerably greater than is now the case along the Arctic Coast of Alaska. The rarity of the polar bear and the absence of any other land mammal which is used for food would indicate that trichinosis here is transmitted also by sea mammals to man. I have observed numerous trichinosis infections among the Saint Lawrence Island dogs, which are also fed largely upon the flesh of walrus and various species of seals. It is possible that dogs might become infected from consuming infected carcasses of the arctic fox, although in view of present information this would seem unlikely.

Speciation on the basis of morphological characters of tapeworms of the genus *Diphyllobothrium* is impossible for Alaskan forms. This precludes any concept of host specificity and prevents any attempt at the control of human infections from an epidemiological standpoint. We are conducting life cycle and animal infection studies in an attempt to clarify these problems.

Tapeworm Infections

The interrelationship of man-dog-ruminant (i. e., caribou and moose) in Arctic Alaska contributes much to the possibility of human *Echinococcus* infection. On the mainland the epidemiological pattern is typical. However, the importance of small rodents (*Microtus*) as intermediate hosts of this parasite is not understood. The fact that these voles serve as the predominant intermediate host on Saint Lawrence Island and our failure to find infected animals of the same and closely related species on the mainland is of unusual interest (*11*). Two factors may be considered: either we are dealing with two species of parasite, both of which infect man, or the situation is greatly affected by the population dynamics of the fox and rodent hosts. As is well known, arctic rodent populations are in a constant state of fluctuation, so that they differ each given year within the approximately 4-year cycle period. Also, where two or more species of small microtine rodent (e. g., *Lemmus*, *Dicrostonyx*, *Clethrionomys*, and *Microtus*) occur together, their cycles usually are not in phase. Thus, while a given species may be very abundant, others in the same region may be

very rare. This requires long-term investigation of each species, and adequate material for study is only obtainable under these conditions. There has been considérable controversy in the past regarding speciation of *Echinococcus*. According to the work of Henschen and Bircher (*4*), in Europe, at least two species are clearly recognizable. We have yet to eliminate this possibility, particularly by means of experimental infections. Another point of much interest is the apparent rapid growth of these *Echinococcus* cysts in the rodent intermediate host. According to presently available information, the usual life span of voles of the genus *Microtus* is believed to be only about a year. This does not seem to be in accord with the usual concept of the rate of development of the *Echinococcus* cyst. We expect to clarify these points by experimental work.

If conditions in Alaska are allowed to remain relatively unchanged in regard to biotic interrelationships, there should be opportunity for the clarification of various public health problems of considerable importance in more northern climates. Such work as outlined in this paper is only possible under conditions of an undisturbed ecology.

REFERENCES

(*1*) Brandly, P. J., and Rausch, Robert: Preliminary report on trichinosis in Alaska. Arctic **3**: 105–107 (1950).

(*2*) Dubois, G., and Rausch, Robert: Troisieme contribution a l'etude des strigeides (Trematoda) Nord-Americains. Bull. Soc. Neuchat. Sc. Nat. **73**: 19–50 (1950).

(*3*) Elton, C.: Voles, Mice, and Lemmings. Oxford, 1942, 496 pp.

(*4*) Henschen, C., and Bircher, R.: Zur Epidemiologie, Pathologie und Chirurgie des *Echinococcus alveolaris*. Bull. Schweiz. Akad. d. med. Wissensch. **1**: 209–224 (1945).

(*5*) Kuns, M., and Rausch, Robert: An ecological study of helminths of some Wyoming voles (*Microtus* spp.) with a description of a new species of *Nematospiroides* (Heligmosomidae: Nematoda). Zoologica **35**: 181–188 (1950).

(*6*) Rausch, Robert: Notes on microtine rodents from the Brooks Range, Arctic Alaska. J. Wash. Acad. Sc. **40**: 133–136 (1950).

(*7*) Rausch, Robert: Notes on the distribution of some arctic mammals. J. Mammal. **31**: 464–466 (1950).

(*8*) Rausch, Robert: Studien an der Helminthenfauna von Alaska. IV. *Haploparaxis galli* n. sp. ein Cestode aus dem Schneehuhn, *Lagopus rupestris* (Gmelin). Ztschr. Parasitenk. **15**: 1–3 (1951).

(*9*) Rausch, Robert: Observations on a cyclic decline of lemmings (*Lemmus*) at Point Barrow, Alaska, during the spring of 1949. Arctic **3**: 166–177 (1951).

(*10*) Rausch, Robert, and Locker, Betty: Studies on the helminth fauna of Alaska. II. On some helminths parasitic in the sea otter *Enhydra lutris*, (L.). Proc. Helm. Soc. Washington. **18**: 77–81 (1951).

(*11*) Rausch, Robert, and Schiller, E. L.: Hydatid disease (*Echinococcosis*) in Alaska, and the importance of rodent intermediate hosts. Science **113**: 57–58 (1951).

(*12*) Rausch, Robert, and Tiner, Jack D.: Studies on the parasitic helminths of the North Central States. II. Helminths of voles (*Microtus* spp.). Preliminary report. Am. Midl. Nat. **41**: 665–694 (1949).

(*13*) Schiller, E. L.: Studies on the helminth fauna of Alaska. I. Two new cestodes from Sabine's gull, *Xema sabini*. J. Parasitol. (in press).

(*14*) Schiller, E. L.: Studies on the helminth fauna of Alaska. III. *Hymenolepis kenaiensis* n. sp. a cestode from the greater scaup (*Aythya marila nearctica*) with remarks on endemicity. Trans. Am. Microbiol. Soc. (in press).

(15) Schiller, E. L.: Studies on the helminth fauna of Alaska. VI. The parasites of the emperor goose (*Philacte canagica* L.) with the description of *Hymenolepis philactes*, n. sp. J. Parasitol. 37: 217–220 (1951).
(16) Schiller, E. L.: Cestoda of anseriformes of the North Central States. Am. Midl. Nat. (in press).
(17) Thorborg, N. B., Tulinius, S., and Roth, H.: Trichinosis in Greenland. Acta path. Microbiol. Scandinav. 25: 778–794 (1948).
(18) Tiner, J. D., and Rausch, Robert: Two new *Syphacia* (Nematoda: Oxyuridae) and observations on the inner circle circumoral papillae in North American species of the genus. Nat. Hist. Misc. No. 57, pp. 1–6, 1950.
(19) Van Cleave, H. J., and Rausch, Robert: A new species of the acanthocephalan genus *Arhythmorhynchus* from sandpipers of Alaska. J. Parasitol. 36: 278–282 (1950).
(20) Van Cleave, H. J., and Rausch, Robert: The acanthocephalan parasites of eider ducks. Proc. Helm. Soc. Washington. 18: 81–84 (1951).

Phlyctenular Keratoconjunctivitis Among Alaskan Indians and Eskimos

By Milo H. Fritz, M. D., and Phillips Thygeson, M. D., *Ophthalmologists**

A high prevalence of corneal scars among Alaskan Indians and Eskimos was first noted by Mould (*1*), who attributed them to epiblepharon, and later by Fritz (*2*) and by Fields (*3*), who showed that they were due almost entirely to past or present phlyctenular keratoconjunctivitis. In the summer of 1949, a study by Fritz, Thygeson, and Durham (*4*) showed that scars attributable to phlyctenulosis were demonstrable in 35 percent of the children in the summer school at Mount Edgecumbe, in 45 percent of the patients in the Orthopedic Hospital, and in 25 percent of the patients in the Tuberculosis Sanatorium (see table 1). Since these school children and patients had come to Mount Edgecumbe from all parts of Alaska, the study threw into sharp relief the importance of the problem of phlyctenulosis in relation to vision throughout the Territory. In 1950, a series of etiologic and therapeutic studies were undertaken by Thygeson and Fritz, and the following report summarizes the results to date of the two summers' work.

Clinical Picture

The active disease among Alaskan Indians and Eskimos was characterized by acute attacks of keratoconjunctivitis of which the principal lesion was the focal reaction known as the phlyctenule. The phlyctenules tended to occur in crops with the heaviest localization at the limbus, but widespread involvement of the cornea and con-

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Table 1. *Prevalence of phlyctenulosis in Alaskan Indians and Eskimos, 1949–50*

Group	Number of examinations		Phlyctenulosis					
			Number				Percent	
			Active		Inactive			
	1949	1950	1949	1950	1949	1950	1949	1950
Mount Edgecumbe School[1]	404	508	10	4	133	124	35.4	25.2
Orthopedic Hospital, children, Mount Edgecumbe	66	63	1	2	29	25	45.4	42.9
Patients in Tuberculosis Sanatorium, Mount Edgecumbe	146	116	2	4	55	41	39.0	38.8
Sheldon-Jackson School, Sitka	--------	134	--------	0	--------	20	--------	14.9
Hydaburg, general population	--------	198	--------	1	--------	20	--------	10.6
Angoon, general population	--------	168	--------	2	--------	41	--------	27.4
All groups	616	1,187	13	13	217	274	37.3	24.2

[1] 1949 summer school; 1950 winter school.

junctiva was also common. The attacks varied in severity and duration: mild attacks tended to clear spontaneously within 10 or 15 days, and more severe attacks tended to last 2 or 3 weeks or longer. In a few chronic cases, recurring showers of phlyctenules kept the disease active for several months or longer. Blepharitis, as evidence of secondary bacterial infection, occurred in some 18 percent of the phlyctenulosis series. There were many more cases, however, including some of the most severe, in which there was no history of blepharitis and no evidence thereof. The majority of active cases occurred in females, but no significant sex difference was noted in the series of inactive phlyctenulosis cases (table 2).

The inactive cases of phlyctenulosis displayed characteristic scars involving most commonly the periphery of the cornea at the limbus but also, in many instances, the pupillary area itself. Visual acuity in children with corneal scars, as a group, was definitely inferior to that in children with unscarred corneas (table 3 and chart). There were a number of children whose visual acuity had been reduced to 20/200 or less. No other important cause of corneal scarring was

Table 2. *Prevalence of phlyctenulosis in selected groups of Indian and Eskimo children, 1949–50*

Group	Number examined	Phlyctenulosis		
		Number		Percent
		Active	Inactive	
Mount Edgecumbe School, 1949:				
Male	206	2	62	31.0
Female	198	8	71	39.9
Mount Edgecumbe and Sheldon-Jackson School, 1950:				
Male	356	3	79	22.9
Female	286	1	65	23.1

observed. There were a few scars from trauma and one case of trachoma but no instances of scarring related to epiblepharon or trichiasis.

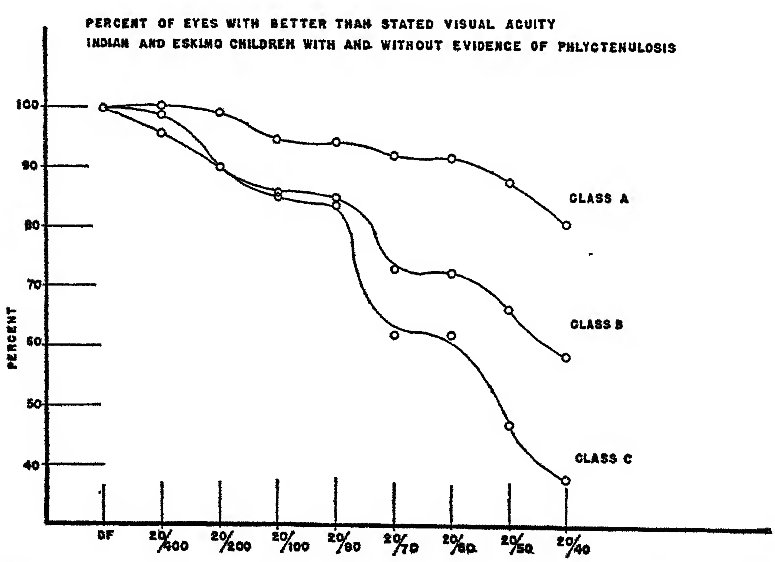
Table 3. *Number of eyes with specified visual acuity and percent with better than specified visual acuity; Indian and Eskimo children with and without evidence of phlyctenulosis*

Visual acuity	Number of eyes			Percent of eyes with better than stated visual acuity		
	Class C [1]	Class B [1]	Class A [1]	Class C	Class B	Class A
Count of fingers	1	2	0	99.0	99.0	100.0
20/400	1	7	0	98.0	95.5	100.0
20/200	9	12	2	89.1	89.5	99.0
20/100	5	6	9	84.2	86.5	94.5
20/80	1	3	0	83.2	85.0	91.5
20/70	22	24	5	61.4	73.0	92.0
20/60	0	1	1	61.4	72.5	91.5
20/50	15	14	8	46.5	66.5	87.5
20/40	9	14	14	37.6	58.5	80.5
Above 20/40	38	117	161			
Total	101	200	200			

[1] Class A: No evidence of past or present phlyctenulosis.
B: Evidence of active or inactive phlyctenulosis.
C: Evidence of phlyctenular scars involving the pupillary area.

Prevalence

The slit-lamp and corneal microscope were used in examinations for active and inactive phlyctenulosis among Alaskan Indians and Eskimos. As seen in table 1, the percentage of individuals showing scars from phlyctenulosis varied from a low of 10.6 percent in the general population of Hydaburg to a high of 45.4 percent in the patients in the Orthopedic Hospital in the summer of 1949.



The findings in Alaska appear to parallel those of native populations of northern Canada and Greenland. In Canada a cooperative study between the University of Alberta and the Canadian government is under way, and a preliminary survey of the native population of the Mackenzie River basin has already demonstrated a high prevalence of the disease in that area.

Etiology

The cause of phlyctenulosis has not yet been established with certainty. The theory receiving most support at the present time postulates that the disease is not an etiologic entity but a bacterial allergy, most commonly attributed to the products of the tubercle bacillus. In support of this theory, our studies have contributed the following items: (1) All cases with active phlyctenulosis showed positive tuberculin reactions and X-ray evidence of active or inactive tuberculosis; (2) a comparative study of the populations of two villages—Hydaburg with a low tuberculosis rate of 3 percent, and Angoon with a high tuberculosis rate of 17.7 percent—showed a parallelism between the prevalence of the two diseases; (3) the prevalence of phlyctenulosis was twice as high among the Eskimo school children from northwestern Alaska, in whom the tuberculosis rate is high, as among the Indian children of southeastern Alaska, in whom the tuberculosis rate is relatively low; and (4) cortisone applied topically was extraordinarily effective in aborting acute attacks of the disease.

Attacks of acute phlyctenulosis were seen in Indians and Eskimos with active pulmonary tuberculosis and with active bone or joint tuberculosis, and in clinically well individuals with X-ray evidence of old healed primary tuberculosis and positive skin reactions. In general, the most destructive eye lesions were seen in children with active bone and joint tuberculosis, but badly scarred corneas also occurred in children and adults with no active systemic tuberculosis. The mechanism by which an acute attack of phlyctenulosis is unleashed is still uncertain, but the following two possibilities have been under study: (1) An activated tuberculous focus may liberate antigenic products into the bloodstream; and (2) a secondary bacterial infection may have the nonspecific effect of bringing circulating tuberculous antigens to the conjunctiva as a result of nonspecific vessel dilation. The effect of epidemic Koch-Weeks bacillus conjunctivitis and pneumococcus conjunctivitis in exciting acute attacks in susceptible children has been observed repeatedly by us in the United States. In our Alaskan series, chronic bacterial infection, such as blepharitis, could not be shown positively to be an exciting factor, although among Mount Edgecumbe and Sheldon-Jackson school children in 1950, the prevalence of blepharitis in phlyctenulosis cases was 18

percent (27/148) as compared with only 1 percent (6/494) in non-phlyctenulosis cases.

The bacteriological findings from each eye of nine cases of active phlyctenulosis observed in 1949 follow:

Case No.	Right eye		Left eye	
	Activity	Flora	Activity	Flora
1	−	Normal flora	−	Coagulase-positive staphylococci; diplobacilli.
3	+	Coagulase-positive staphylococci	−	Coagulase-positive staphylococci.
11	−	do	−	Normal flora.
17	+	Alpha hemolytic streptococcus	−	Do.
31	+	Normal flora	−	Coagulase-positive staphylococci.
41	−	Coagulase-positive staphylococci	+	Do.
52	−	do	+	Normal flora.
97	−	do	−	Coagulase-positive staphylococci.
105	−	do	−	Do.

The above findings may be compared with the flora from conjunctivae and lid margins of 98 cases of inactive phlyctenulosis studied at the same time. Half of these, 49, had normal flora, and 40 of them had coagulase-positive staphylococci present. Eight of the latter and nine other persons harbored one of the following other pathogens: pneumococci, 8; *H. influenzae*, 3; diplobacilli of Morax-Axenfeld, 2; γ hemolytic streptococcus, 3; and nonhemolytic streptococcus, 1.

Activation of a tuberculous focus as a cause of acute attacks was suggested by the elevated sedimentation rates in acute cases as compared with the rates in inactive cases; but if activation occurred it was insufficient to produce obvious clinical signs such as fever. The importance of establishing the cause of acute attacks is apparent, and our studies are continuing.

Therapy

Up to the present time there has been no way of aborting attacks of phlyctenulosis. The favorable effects of tuberculin desensitization, antituberculous dietary regime, and topical application of antiseptics for the control of secondary infection are well known but never have been dramatic. In view of the results obtained with cortisone in allergic diseases, a trial with the hormone seemed to be indicated, particularly in view of the typical occurrence of phlyctenulosis in acute, self-limited attacks.

A total of 14 cases of active phlyctenulosis was treated with topical applications of cortisone, 12 with drops and 2 by subconjunctival injection. The results in each case were dramatic, the inflammation subsiding within 24 hours in mild cases and within 48 hours in more severe cases. In two cases the activity of the disease was approximately equal in both eyes; cortisone instilled in the right eyes only, aborted the attacks in these eyes within 48 hours, while the control

eyes continued in full activity until treated in turn with cortisone 10 days later. In two cases with chronic phlyctenulosis which had been active for several months, cortisone was equally effective. The cortisone studies are being extended but the preliminary results would seem to suggest that a practical means of controlling acute attacks of the disease, and thus of preventing corneal scarring, may have been found. Full control of the disease, however, must await elimination of tuberculosis from the population.

REFERENCES

(*1*) Mould, Ward L.: Corneal opacities in the Alaskan Eskimo. Arch. Ophth. **24**: 972–974 (1940).
(*2*) Fritz, Milo H.: Corneal opacities among Alaska natives. Alaska's Health. **5**: (1947).
(*3*) Barnett, Harry E., Fields, Jack, Milles, George, Silverstein, George, and Bernstein, Arthur.: Medical conditions in Alaska. J.A.M.A. **135**:500–510 (1947).
(*4*) Fritz, Milo H., Thygeson, P., and Durham, D.: Phlyctenular keratoconjunctivitis among Alaskan natives. Am. J. Ophth. **34**: 177–184 (1951).
(*5*) Thygeson, P., and Fritz, Milo H.: Cortisone in the treatment of phlyctenular keratoconjunctivitis. Am. J. Ophth **34**: 357–360 (1951).

Climatic Adaptation in Arctic and Tropic Animals

By Laurence Irving, *Biologist*

The few species of resident arctic mammals and birds encounter environmental temperatures as low as −50° C. while preserving body temperatures around +37° C. In wide areas of the Tropics, common environmental temperatures of around +30° C. give a gradient between the body and environment of only 7°, which is in sharp contrast with the gradient of about 90° which arctic animals must sustain.

Measurements of the rate of heat transfer through pieces of skins from 18 arctic and 16 tropic mammals showed that they had in common an insulating value that varied with the fur thickness. The skins approximated the efficiency of any good insulator equally thick and containing a large proportion of trapped air. Among arctic animals insulation increased with the animal's size to a maximum at the weight of a 5-kilogram fox and did not change among the larger forms. We know that arctic foxes and larger animals do not need to seek shelter from the coldest arctic weather, but the smaller ones avoid

NOTE: This material summarizes the results of experimentation in the Arctic Research Laboratory, Point Barrow, and in the Canal Zone Biological Area. *See* Scholander, Hock, Walters, Johnson, and Irving, Biol. Bull. 99: 225-271 (1950).

extreme cold more or less in nests or burrows. Among tropical animals the insulation is not large, but it is measurable and larger than in some small arctic species.

The basal metabolic rate in various environmental temperatures was determined by open circuit methods in six species of arctic mammals and in three birds, and in six tropic mammals and two birds. In the literature other records were found for 13 species of domesticated and wild mammals and 7 birds. No data for man was found adequate for valid comparison with other animals.

Study of this data showed that it might be formulated according to the law of cooling, as

$$\Delta T = K \times H \times I$$

in which ΔT is the difference between body and environmental temperature, K is a constant of the dimensions used, H is the heat production of metabolism, and I is the insulation. Arctic animals as large as foxes withstood experimental temperatures to $-30°$ C. without changing metabolic rate. From visual observation of foxes at $-60°$ C. they were unaffected by cold. According to theory and observation, the well-insulated arctic animals can preserve body temperature by only basal metabolic rates at temperatures around $-60°$ C. They can, while in the same fur, also endure $+30°$ C. Since metabolism remains constant over this range of temperature, insulation operates as the variable concerned in arctic adaptation, and it is not only large but adjustable to wide changes in the temperature gradient which arctic animals may encounter.

Many tropical mammals increase their metabolism as temperature falls below $+25°$ C. and show signs of suffering from cold below $+20°$ C. Their insulation is not only small but also correspondingly inflexible. In fact, as would be expected from theory, tropical animals appear frequently to suffer from minor decreases of their environmental temperature, whereas arctic animals with their great and highly adjustable insulation are quite oblivious to extremes of arctic cold.

The metabolic rates of the arctic and tropic animals vary with size according to the familiar relation $H = K \times W^{3/4}$. Warm-blooded animals of all climates thus have a common scheme of basal metabolism which is not adaptive in rate to the temperature of their environment. Body temperature of warm-blooded animals, excluding hibernators, is also nonadaptive. The only adaptive system in the animal economy of basal heat production is the insulation.

The remarkable adjustability of insulation shown by the wide range of temperatures accepted by arctic animals indicates that the insulation referred to is physiologically variable and is not simply that of dead skin and inert fur. The fact that the complex of physical

and physiological devices, which this discussion designates as insulation, varies as a single factor shows that the component devices vary in size together. These views will be useful in the analysis, now in progress, of the interesting physiological mechanisms involved in the adjustment of animals to cold. It is expected that an inclusive description of the widely differing capacities of animals to withstand cold will point out experimentation for a critical definition of what degree and kind of adaptation to cold man possesses.

Facilities and Opportunities for Research at the Arctic Health Research Center

By Jack C. Haldeman, M. D., ***Medical Officer in Charge***

Our pattern of organization differs from that of many research activities in Alaska in that the work is largely carried out by a staff resident in the Territory devoting full time to investigation. Anchorage was selected as a base of operations, since it is a principal transportation center and offered the best opportunity for renting and converting suitable space for laboratory facilities as well as for obtaining housing for our personnel. We hope eventually to move our activities to College, Alaska, to a site which has been donated to the Federal Government for the purpose by the University of Alaska.

The recruitment of our professional staff has not been as difficult as anticipated, possibly because of the unparalleled opportunities for research in the area. I believe, however, that living conditions satisfactory for normal family life must be made available if any organization is to engage successfully in long-term basic or developmental research in low-temperature areas. I would also like to stress the importance of having a well-trained administrative staff. Problems relating to the acquisition of supplies and equipment, rental of space, contracts, personnel and fiscal actions are difficult and unique in Alaska, and if inefficiently handled, can cripple and demoralize the scientific staff.

Soon after our program was established in 1948, we were fortunate in being able to rent a building containing approximately 9,000 square feet which could be converted for laboratory bench research. This building is now equipped with stainless-steel laboratory furniture, and the acquisition of modern scientific equipment has been given first priority in the initial stages of the program. Walk-in refrigeration and incubation space is provided, as well as deep-freeze units. Sup-

porting scientific services provided in this building include the care and breeding of small laboratory animals, media making, and dishwashing. The administrative staff is located in a building next door. The entomological laboratory, entomological shop, instrument shop, arctic animal house, and storage facilities occupy space at four other locations in the Anchorage area.

Our staff is accumulating considerable first-hand knowledge of the Territory, particularly of the northern and comparatively unknown sections. Staff members have also learned how to travel in these areas with a minimum of discomfort, delay, and expense. To conduct biological surveys is not our primary function, but, as accurate information on biological backgrounds is essential, our staff members have acquired knowledge in the natural history and distribution of Alaskan mammals, birds, insects, animal parasites, and fresh-water crustaceans.

At this point, we would like to offer our experience and knowledge of Alaska as a means of assisting our Stateside colleagues in preparing for field trips in these areas. We would also like to offer the consultative service of our scientific staff and, within present physical limits, the use of our facilities.

The opportunities for profitable collaboration may best be illustrated by a brief description of the specific scientific areas in which we have experience, and a general description of our facilities and equipment.

In physiology, we have a staff of four scientists trained in comparative physiology and experienced in arctic field studies. Equipment is available for research relating to the natural adjustments of animals to cold. Measurement of respiratory metabolism at controlled temperatures in warm-blooded animals of various sizes is carried on by open circuit systems. Temperature of the body and skin is measured by means of thermocouple equipment. For studying one phase of the interesting problem of how cold-blooded animals manage to survive in an arctic climate, oxygen consumption is measured at controlled temperatures by the use of various sized Scholander respirometers. A cold test room, with an inside diameter of 3 by 3 by 5 feet, provides regulation of temperatures ranging from $+35°$ C. to $-55°$ C.

Our biochemistry and nutrition studies are carried out by a staff of three biochemists and one physiologist. In the biochemistry laboratory, special equipment is available for food analysis, clinical chemistry, enzyme chemistry, and for the study of tissue respiration, as well as more general facilities for other biochemical specialties. Limited facilities for organic syntheses and biochemical preparations have been provided. We have specialized equipment for the microdetermination of blood constituents important in assessing human

nutrition. Suitable facilities for experiments in small animal nutrition are available.

The scientific personnel responsible for animal-borne disease studies include three members. Their combined training and experience encompasses veterinary medicine, general parasitology, helminth taxonomy, and, to a certain extent, mammalian taxonomy and pathology. The laboratory is equipped with autopsy facilities and the other apparatus necessary for parasitological investigations. An artificial digestion apparatus is available for recovery of trichina larvae from animal tissue. Other equipment includes a rotary and a freezing microtome, aquaria, and a dark room for macro- and microphotography.

The entomological and insect control activities are staffed by an entomologist, an aquatic biologist, an entomological engineer, and an insect control specialist. The entomological laboratory contains an insectary and an insect collection. The entomological shop contains equipment necessary for the development and construction of special types of equipment for Alaskan insect control operations.

Two bacteriological laboratories are maintained. One is devoted to the study of the biological aspects of water supply and sewage disposal and the other to the study of infectious diseases. Space is provided for a branch laboratory of the Alaska Department of Health, which, in turn, makes available for our special investigations specimens submitted to it for routine diagnostic work.

Engineers engaged in environmental sanitation studies are using a pilot well and experimental septic tank installations located on the ground of the University of Alaska. Facilities operated by the city of Fairbanks and the Air Force at Ladd Field are also being utilized.

The hospital facilities of the Alaska Native Service have been freely used in our studies, as well as facilities of the Arctic Research Laboratory at Barrow and the Aeromedical Laboratory at Fairbanks.

The establishment of a research library was considered an essential step in the development of the Center in view of the current lack of library resources in the biological fields in the Territory. Although emphasis has been placed on the acquisition of bibliographic aids, the library receives and circulates approximately 200 different scientific periodicals as well as a weekly list of library accessions. Through active participation in the formative stages of project development, our librarians have been able to anticipate needs for specific reference material and to obtain needed publications, microfilms, and photostats with a minimum lapse of time. Needless to say, the facilities of the library have been used extensively by visiting scientists and other individuals and organizations.

A very important supporting service to our investigative program is the instrument shop. This unit is equipped to do all ordinary

metalwork, such as turning, cutting and welding, small wood and plastic work, and sheet metalwork of limited size. It is also equipped for the small and high precision metalwork required in the construction of instruments. The facilities of the Civil Aeronautics Administration shop have been generously made available to us for heavy machine work.

An animal house, erected on the outskirts of Anchorage, contains a collection of native animals under conditions approximating their natural habitat. Those now on hand include such hibernators as black bears, marmots, and ground squirrels, and, in addition, red and blue foxes, tree squirrels, porcupines, weasels, geese, conies, and Eskimo dogs. Even the Norway rat, which has unfortunately demonstrated its adaptability to life near the Arctic Circle, is represented. The capture of native animals has been a problem of considerable magnitude. Some were obtained through cooperation of officials of the Fish and Wildlife Service, others as a result of our own trapping.

In determining the status of animal-borne diseases, the help of expert Eskimo observers of wild life has been particularly useful. In most of the biologically significant areas of the North, we have established contact with individuals who, at our request, will in the course of their normal hunting and trapping, preserve the particular parts of animals needed in our studies. Through their cooperation, our program has been accelerated and extended far beyond expectations and beyond the limits of our own physical capacity.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended June 30, 1951

There was a 60-percent increase in the number of cases of poliomyelitis for the current week (341) as compared with the previous week (211), all sections of the country contributing in varying degrees to the increase. The number of cases reported for the same week in 1950 was 389, and in 1949, 481. The region showing the largest numerical increase from the previous week was the West South Central which had 106 cases for the current week as compared with 61 for the previous week. Since the seasonal low week late in March, 1,619 cases have been reported as compared with 2,047 last year, and 2,270 in 1949.

Of the 12 cases reported in the New England States, 7 occurred in Massachusetts and 5 in Connecticut. The Middle Atlantic States showed an increase of 10 cases from the previous week. In the East and West North Central and Mountain regions, the increase was slight. In Illinois the number of cases reported increased from 8 for the week ended June 23 to 17 for the current week, 8 of which were in Cook County.

In the South Atlantic region, 45 cases were reported for the current week and 18 for the previous week. Twenty-eight of the 45 occurred in Georgia and Florida. The East South Central States showed a slight increase from the previous week—29 as compared with 25. However, in Alabama there was a decrease from 18 to 14 cases.

The increase in the number of cases in the West South Central region occurred principally in Texas, 33 cases being reported last week and 62 for the current week. Likewise, in the Pacific States, the increase from 31 cases last week to 54 for the current week was was confined principally to California where the numbers were 28 and 48, respectively.

In Texas, poliomyelitis cases have been concentrated in Nueces County and, more recently, in the adjoining county of San Patricio. The large cities have also contributed a large proportion. In Louisiana, where 22 cases (16 paralytic) were reported for the current week, 13 were in Shreveport. In Alabama, 8 of the 14 cases reported were in Birmingham.

Q Fever

Dr. T. O. Carver, Idaho Department of Public Health, reports preliminary results of an investigation of 16 cases of Q fever from an area around Gooding. Most of the patients have been associated with the sheep industries. Diagnosis in the 16 cases was confirmed by complement fixation tests performed at the Public Health Service Rocky Mountain Laboratory at Hamilton, Mont. Further studies of the disease in sheep and dairy cattle in the area are in progress.

Infectious Hepatitis

Dr. L. M. Schuman, Illinois Department of Public Health, has reported 43 cases of infectious hepatitis in a small rural community in Illinois. Three or four cases were reported in May, but investigation revealed that cases have been occurring since December 1950. Most of the persons affected were children attending a single school. Sanitary facilities of the school did not appear to be associated with spread of infection. None of the 11 adults affected had any association with school cases, directly or indirectly. Many families in which cases occurred owned dogs but none of the animals had any evidence of illness. The cases were mild with no fatalities, but the clinical picture was typical of infectious hepatitis.

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5 year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5 year median 1945–46 through 1949–50	Cumulative total for calendar year—		5 year median 1946–50
	June 30, 1951	July 1, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	------	4	2	(1)	(1)	(1)	(1)	39	24	28
Diphtheria (055)	52	58	86	27th	4,878	7,338	10,872	1,971	3,067	4,514
Encephalitis, acute infectious (082)	22	22	11	(1)	(1)	(1)	(1)	447	366	236
Influenza (480–483)	407	299	265	30th	129,688	148,462	148,462	115,146	137,878	127,599
Measles (085)	8,544	7,940	8,006	35th	465,120	284,538	552,242	436,419	265,409	517,296
Meningitis, meningococcal (057.0)	59	72	50	37th	3,408	3,192	3,080	2,447	2,279	2,108
Pneumonia (490–493)	677	1,102	(2)	(1)	(1)	(1)	(1)	42,312	55,309	(1)
Poliomyelitis, acute (080)	341	389	362	11th	1,619	2,047	2,020	2,832	3,178	2,368
Rocky Mountain spotted fever (104)	20	22	22	(1)	(1)	(1)	(1)	130	168	175
Scarlet fever (050)[3]	652	487	780	32d	66,650	54,756	78,604	40,959	38,317	56,060
Smallpox (084)	------	------	-------	35th	15	43	66	7	23	45
Tularemia (059)	9	15	27	(1)	(1)	(1)	(1)	348	511	514
Typhoid and paratyphoid fever (040,041)[4]	71	94	98	11th	685	912	962	1,120	1,422	1,447
Whooping cough (056)	1,270	2,289	2,152	89th	[5]60,948	90,721	81,382	[5]39,346	69,205	50,116

[1] Not computed.
[2] Data not available.
[3] Including cases reported as streptococcal sore throat.
[4] Including cases reported as salmonellosis.
[5] Addition: West Virginia, week ended June 23, 34 cases.

Rabies

The first case of human rabies in Texas since 1948 occurred in a border county in June. The victim, a boy, was bitten 2 months prior to onset of symptoms. No antirabies vaccine had been given. Eight laboratory confirmed cases in animals have been found in the vicinity since January 1.

Gastroenteritis

Dr. D. H. Stevens, Maine Commissioner of Health and Welfare, has reported an outbreak of food poisoning in Lewiston. Twelve persons who ate Italian sandwiches were affected. Specimens of sandwiches made up from the original batch of ingredients were found to contain *Streptococcus viridans* and *B. coli.* None of the food handlers showed evidence of infection.

Dr. Patricia Husson, Erie County (New York) Health Department, reported 8 cases of afebrile gastroenteritis in 10 people attending a birthday party in Buffalo. The average incubation period was 32 hours. The vehicle was thought to be a frosted layer cake bought from a bakery. No fault was found in preparation or handling of the cake, and laboratory examination of the leftover cake and of the stools of one patient did not reveal pathogens.

Psittacosis

Dr. J. F. Mahoney, New York City Commissioner of Health, reports the occurrence of two cases of psittacosis.

Reported Cases of Selected Communicable Diseases: United States, Week Ended June 30, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**52**	**22**	**407**	**8,544**	**59**	**677**	**341**
New England	**3**	**1**	**1**	**785**	**2**	**25**	**12**
Maine	3	-	1	52	1	3	-
New Hampshire	-	-	-	4	-	2	-
Vermont	-	-	-	102	-	-	-
Massachusetts	-	1	-	526	1	-	7
Rhode Island	-	-	-	28	-	3	-
Connecticut	-	-	-	73	-	17	5
Middle Atlantic	**6**	**5**	**6**	**2,551**	**11**	**87**	**23**
New York	3	2	[1] 5	1,395	5	45	17
New Jersey	-	3	1	655	4	19	3
Pennsylvania	3	-	-	501	2	23	3
East North Central	**5**	**6**	**7**	**1,070**	**12**	**101**	**39**
Ohio	2	-	-	369	4	-	3
Indiana	1	-	3	30	1	4	-
Illinois	-	-	2	434	5	48	17
Michigan	1	6	2	237	2	49	9
Wisconsin	1	-	-	-	-	-	10
West North Central	**1**	-	**14**	**581**	**3**	**64**	**18**
Minnesota	1	-	2	17	-	2	2
Iowa	-	-	-	326	-	-	2
Missouri	-	-	1	94	2	2	-
North Dakota	-	-	10	52	-	45	5
South Dakota	-	-	-	22	-	-	-
Nebraska	-	-	-	12	-	-	3
Kansas	-	-	1	58	1	15	6
South Atlantic	**9**	**1**	**166**	**920**	**16**	**76**	**45**
Delaware	-	-	-	36	-	-	3
Maryland	1	1	3	271	3	17	1
District of Columbia	-	-	-	30	-	15	1
Virginia	3	-	160	317	3	31	3
West Virginia	1	-	-	53	1	-	2
North Carolina	4	-	-	84	2	-	6
South Carolina	-	-	2	21	4	6	1
Georgia	-	-	1	70	1	7	13
Florida	-	-	-	38	2	-	15
East South Central	**9**	**6**	**1**	**130**	**5**	**46**	**29**
Kentucky	-	-	-	33	1	6	2
Tennessee	1	-	-	42	2	-	5
Alabama	5	4	-	48	2	29	14
Mississippi	3	2	1	7	-	11	8
West South Central	**11**	**2**	**26**	**599**	**4**	**192**	**106**
Arkansas	-	-	14	68	1	13	9
Louisiana	1	-	1	9	-	27	22
Oklahoma	2	-	11	35	-	11	13
Texas	8	2	-	487	3	141	62
Mountain	**4**	-	**160**	**466**	**1**	**28**	**15**
Montana	-	-	3	118	-	-	-
Idaho	-	-	-	81	-	-	-
Wyoming	-	-	-	70	1	3	-
Colorado	1	-	115	30	-	10	2
New Mexico	-	-	-	23	-	4	5
Arizona	3	-	42	70	-	11	8
Utah	-	-	-	74	-	-	-
Nevada	-	-	-	-	-	-	-
Pacific	**4**	**1**	**26**	**1,442**	**5**	**58**	**54**
Washington	-	-	6	70	-	-	4
Oregon	1	-	11	295	1	20	2
California	3	1	9	1,077	4	38	48
Alaska	-	-	-	-	-	-	-
Hawaii	1	-	-	20	-	-	-

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended June 30, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [1] (040,041)	Whooping cough (056)	Rabies in animals
United States	**20**	**152**	-	**9**	**71**	**1,270**	**112**
New England	-	**70**	-	-	**1**	**29**	-
Maine	-	2	-	-	-	4	-
New Hampshire	-	[2] 2	-	-	-	2	-
Vermont	-	-	-	-	-	-	-
Massachusetts	-	58	-	-	1	19	-
Rhode Island	-	3	-	-	-	-	-
Connecticut	-	5	-	-	-	4	-
Middle Atlantic	**1**	**152**	-	-	**13**	**101**	**4**
New York	-	[2] 98	-	-	4	45	4
New Jersey	-	17	-	-	2	31	-
Pennsylvania	1	37	-	-	7	25	-
East North Central	**1**	**166**	-	**2**	**10**	**219**	**21**
Ohio	-	37	-	-	5	36	1
Indiana	-	4	-	-	-	16	12
Illinois	1	34	-	2	3	42	2
Michigan	-	73	-	-	-	64	6
Wisconsin	-	18	-	-	2	61	-
West North Central	**1**	**29**	-	**1**	**1**	**61**	**26**
Minnesota	-	7	-	-	-	7	3
Iowa	-	4	-	-	-	9	7
Missouri	-	14	-	-	1	7	16
North Dakota	-	3	-	-	-	9	-
South Dakota	-	-	-	-	-	6	-
Nebraska	1	1	-	-	-	4	-
Kansas	-	-	-	1	-	19	-
South Atlantic	**10**	**40**	-	**2**	**4**	**124**	**18**
Delaware	-	-	-	-	-	1	-
Maryland	-	9	-	-	-	8	-
District of Columbia	-	3	-	-	-	3	-
Virginia	3	2	-	1	-	62	4
West Virginia	-	[2] 3	-	-	2	-	3
North Carolina	4	16	-	-	-	18	-
South Carolina	-	1	-	-	-	6	5
Georgia	3	3	-	1	2	8	6
Florida	-	[2] 3	-	-	-	18	-
East South Central	**1**	**24**	-	**1**	**7**	**72**	**18**
Kentucky	-	3	-	-	2	14	5
Tennessee	1	[2] 11	-	-	2	27	8
Alabama	-	5	-	-	1	19	4
Mississippi	-	5	-	1	2	12	1
West South Central	-	**13**	-	**2**	**16**	**519**	**23**
Arkansas	-	-	-	2	3	55	-
Louisiana	-	2	-	-	1	6	-
Oklahoma	-	2	-	-	5	25	-
Texas	-	9	-	-	7	433	23
Mountain	**5**	**16**	-	**1**	**7**	**51**	**1**
Montana	2	-	-	-	1	7	-
Idaho	1	2	-	-	2	-	-
Wyoming	-	-	-	-	-	9	-
Colorado	1	2	-	-	2	10	-
New Mexico	-	-	-	-	1	4	-
Arizona	-	2	-	-	1	21	1
Utah	1	[2] 10	-	1	-	-	-
Nevada	-	-	-	-	-	-	-
Pacific	**1**	**142**	-	-	**12**	**94**	**1**
Washington	-	9	-	-	-	15	-
Oregon	-	9	-	-	1	4	-
California	1	[2] 124	-	-	11	75	1
Alaska	-	-	-	-	-	-	-
Hawaii	-	-	-	-	-	-	-

[1] Including cases reported as salmonellosis. [2] Including cases reported as streptococcal sore throat.

Psittacosis: Indiana, 1 case; New York City, 2 cases. *Rabies in man:* Texas, 1 case.

FOREIGN REPORTS

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently. A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Cholera

Burma. There were only 2 cases of cholera reported in Mergui for the week ended June 23, 1951, compared with a high of 47 for the week ended May 12. Seven cases were reported in Moulmein for the week ended June 23, as compared with eight for the previous week.

Smallpox

French West Africa. During the period June 1–10, 1951, 116 cases (7 deaths) of smallpox were reported. The incidence was located chiefly in Sudan and Upper Volta.

Indochina. During the week ended June 23, 1951, smallpox was reported in ports of Viet Nam as follows: Haiphong 26 cases, Hanoi 16, and Nam-Dinh 16.

Indonesia. For the week ended June 16, 1951, seven cases of smallpox were reported in Surabaya, Java, and one case was reported in Pekalongan.

Tanganyika. During the week ended May 19, 1951, 79 cases (20 deaths) of smallpox were reported in Tanganyika. The number of cases dropped to 19 during the following week.

Typhus Fever

Portugal. During March 1951, 24 cases of typhus fever were reported in Portugal compared with 4 for February.

Yellow Fever

Brazil. One fatal case of jungle yellow fever was reported on April 27, 1951, in Rochedo County, Mato Grasso State.

Gold Coast. One suspected case of yellow fever was reported May 28, 1951, in Obosumasi about 18 miles east of Nsawam.

The three suspected cases reported for the week ended April 28, 1951, in Aboadzi, Sekondi, and Tarkwa have been confirmed.

Peru. One fatal case of jungle yellow fever was reported April 14, 1951, in Tingo Maria, Huanuco Department, and on April 17, one fatal case was reported in Pucallpa, Lerto Department.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Librarians and others should preserve their copies for binding, as the Public Health Service is unable to supply the general demand for bound copies. Indexes will be supplied upon request.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price $4.75 a year. $6.25 foreign

Public Health Reports

VOLUME 66 JULY 27, 1951 NUMBER 30

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The Membrane Filter in Sanitary Bacteriology

FEDERAL SECURITY AGENCY

PUBLIC HEALTH SERVICE

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PUBLIC HEALTH SERVICE
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Division of Public Health Methods
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Public Health Reports

Vol. 66 • JULY 27, 1951 • *No. 30*

The Membrane Filter in Sanitary Bacteriology

By Harold F. Clark, Edwin E. Geldreich, Harold L. Jeter, and Paul W. Kabler*

Removal of bacteria from liquids by filtration through a membrane that has been prepared from a derivative of cellulose is not a new process. Reviews by Bigelow and Gemberling (*1*), Ferry (*2*), or Pierce (*3*) credit Fick in 1855 with the application of collodion membranes in biological investigations. Numerous improvements and modifications were suggested by various investigators.

A major problem of bacteriology has been the development of rapid, accurate techniques of isolating, identifying, and counting organisms in water, air, and food. The authors of this paper have undertaken what is probably the first systematic series of controlled experiments in the United States to develop and apply techniques employing a membrane filter for this purpose with water. The results reported promise a substantial reduction in the time, labor, and space required for specified phases of bacteriological analysis and, at the same time, they indicate a likelihood that these techniques will be more certain and precise in results than methods now in use. These experiments have a particular significance for the hygienic aspects of waterworks operations. They also imply economies and technical advantages, such as ease of transportation, which would permit bacteriologists to extend their services to small water plants and to rural areas.———M. D. Hollis, *Assistant Surgeon General.*

Zsigmondy and Bachman (*4*) developed a method for the preparation of a membrane that could readily be adapted to commercial production. A United States patent was issued to Zsigmondy (*5*) in 1922 on an application made in 1919. Membranes of this type have been available in Germany for a number of years.

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*Bacteriologists and Senior Surgeon, respectively, Environmental Health Center, Public Health Service, Cincinnati, Ohio.

The trade names appearing in this study are carried as a means of identifying the products under discussion and do not represent endorsement of the product by the Public Health Service.

Filtration procedures using the Zsigmondy membrane were suggested for the determination of bacterial counts, coliform determinations, and isolation of pathogenic strains of bacteria from water and other fluids. Such methods were especially favored in Germany. It appeared to be the consensus of most investigators that the membrane filter method had advantages of speed, accuracy, and simplicity plus a marked saving in manpower, material, and equipment. The most important factors in sanitary bacteriology were the increased volume of sample for examination and reduced incubation periods.

Dr. Alexander Goetz (*6*, *7*), after a detailed investigation of the membrane filter in Europe, has published a complete report of his findings. In his review he described the characteristic properties and the use of the filter. Goetz (*8*), through his cooperative investigations, designed the filtration equipment for holding the membranes during filtration and developed the method of preparation for an improved membrane from domestic materials. His report included technique and methods of application. Dr. Goetz believes the membrane filtration method has definite bacteriological advantages over the usual cultivation procedures on liquids or gels, including the absence of lateral diffusion from neighboring colonies. In the case of coliforms, and probably all other organisms, growth appears to be stimulated on the surface of the membrane.

Apparatus

The filtration equipment used in this laboratory was designed and supplied by Dr. Goetz. The membranes used in this investigation were prepared in his laboratory at the California Institute of Technology, Pasadena, Calif.

Although the Goetz filtering apparatus is constructed of stainless steel, it can be made of glass, porcelain, or any noncorrosive metal. It consists (fig. 1) of a stainless steel funnel, A, connected by a bayonet locking nut, B, to the receptacle, C. The receptacle has a porous plate that supports the filter membrane and allows free passage of liquids. When the membrane is locked in the funnel, all of the fluid must pass through it. The filtrate is collected in a filter flask. Filtration may be accomplished by gravity where a source of vacuum is not available but reduced pressure in the flask greatly increases the rate of flow. Sufficient vacuum can be produced by a hand aspirator or filter pump on water pressure, but an electric vacuum pump is more satisfactory.

The flask was attached to a one-liter equalizing bottle which served both as a water-trap and vessel to equalize the vacuum. Before reaching the electric vacuum pump, the air in this vessel was drawn through an oil trap and a drying tube filled with "Drierite." When the appa-

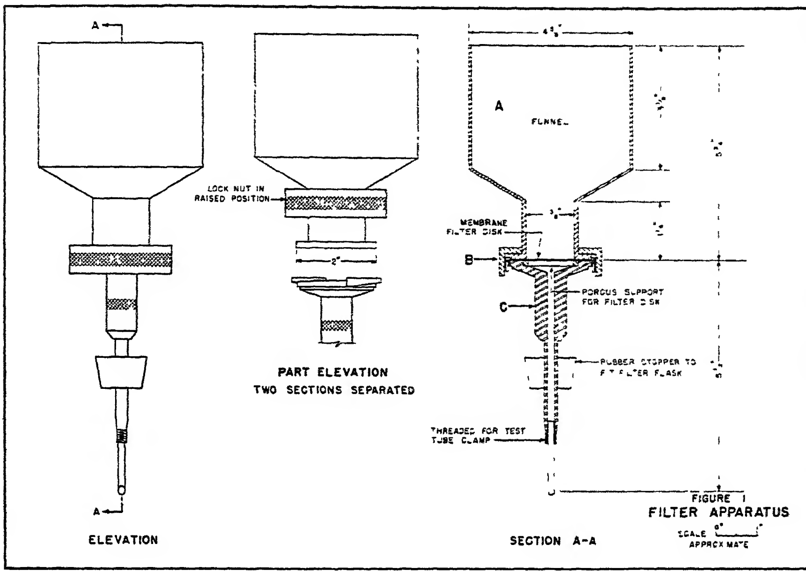

Figure 1. Diagram of Goetz filter apparatus.

ratus was used in research investigations, a mercury manometer was inserted in the vacuum line for measuring the pressure in the system and for testing wet membranes.

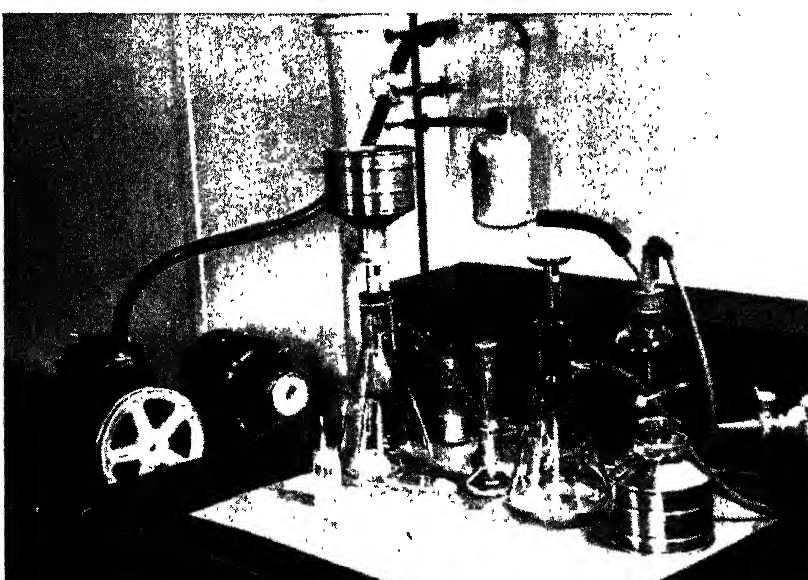

Figure 2. Filtration assembly.

Sterilization Procedure

In all investigations in this laboratory, the funnel was sterilized at 15 pounds steam pressure for 15 minutes. The two parts of the funnel were separately wrapped in kraft paper before autoclaving. It is not necessary to sterilize the funnel between each filtration; the inside surface can be washed down satisfactorily with sterile water. The funnel may be immersed in boiling water for 15 minutes, or even scrubbed in hot soapy water and rinsed in hot water in the absence of autoclaving facilities.

The filter membrane is a circular disk approximately 48 mm. in diameter and 0.1 mm. thick, composed of a cellulose derivative. These membranes were made from American materials by Dr. Goetz (*6*). The membranes are extremely porous. The tubular holes through the disk are parallel to the direction of flow of the liquid, with slightly smaller diameter at the top. The pore size may be controlled in the manufacturing process. Membranes used in this investigation were "low Z."

According to Dr. Goetz (*6*) the "pore size is measured by the determination of a factor Z (Zeit=time) which is necessary to pass 100 cc. of distilled water at room temperature through a filter area of 100 cm. at a differential pressure of one atmosphere (15 lbs.)." The value of Z may range from 5 to 6,000 seconds.

Each membrane must be sterilized before using for cultivation work. Heat is not recommended for routine sterilization of these membranes, although under certain experimental conditions they have been sterilized by repeated boiling in water. A number of methods of sterilization have been suggested. Exposure to ultraviolet light has been used in some laboratories. Sterilization of membranes in this laboratory is obtained by exposure to ethylene oxide vapor, as recommended by Phillips (*9*), Kaye and Phillips (*10*), Phillips and Kaye (*11*), and Kaye (*12, 13*). Briefly, the sterilization procedure consists of placing glassine envelopes, each containing 10 membranes, in a vacuum jar. The air is then evacuated and replaced with a mixture containing one gram of ethylene oxide per liter of air at atmospheric pressure. After an exposure period of 2 hours, all traces of ethylene oxide are removed from the membranes by flushing the jar with air by alternate evacuation and replacement. Since ethylene oxide and air mixtures in certain proportions are explosive, care must be used to avoid fire hazards in the sterilization process. Should traces of ethylene oxide be left in the membrane due to insufficient flushing, it will be lost on exposure to the air in 24 to 48 hours. When received, the membranes contain a small amount of moisture which is necessary for the sterilization process. On the other hand, because of the

difficulty of removing the ethylene oxide from wet membranes, they should not be wet.

Each membrane is protected by a disk of material resembling a good quality white blotting paper. During shipment and storage, the blotting paper protects the membrane from injury. Afterwards it serves as a reservoir for nutritional medium. Some European investigators have used unsterile absorbent disks in their procedure, but it is recommended that these blotting pads be sterilized to eliminate growth of contaminating organisms in the pad with possible diffusion of metabolic products through the membrane. The following procedure is used in this laboratory:

1. Boil pads for 10 minutes each in four successive changes of distilled water, or continue until the distilled water remains colorless (to remove all impurities).
2. Dry at room temperature or in an oven at 103° C. or less.
3. Autoclave for 15 minutes at 121° C. in a suitable container (a Petri dish may contain 20 disks).
4. Dry pads in sterile container.

The remaining equipment, such as pipettes, Petri dishes, etc., is found in the average water laboratory equipped to make a total bacterial count, with the possible exception of an incubator capable of maintaining a saturated humidity at 35°–38° C. The standard electric water bath with a thermostatic temperature control and metal cover is ideal. The water level is maintained at about an inch below the incubation shelf. Small Petri dishes 60 mm. × 15 mm. are most convenient for incubation but the standard Petri dish (100 mm. × 15 mm.) may be used.

Bacterial Counts

Standard Methods for the Examination of Water and Sewage recommends the standard plate count for the estimation of bacterial density in water. In routine procedures, one ml. or less of sample is planted in each Petri dish although in research investigations, samples of 10 ml. have been planted in large Petri dishes (200 mm. diameter). After the solidification of the nutrient agar, the plates are incubated at 35°–38° C. for 24 hours. The colonies are counted. If there are less than 30 colonies or more than 300 colonies on the plate, the colony count is not statistically accurate and such counts are discarded. As treated waters commonly have bacterial densities of less than 30 organisms per ml., the standard plate count loses much of its value. The membrane filter technique has a unique advantage for such samples. The membrane will retain all the bacteria contained

in any quantity of water that can be forced through the filter and, after cultivation for a period of hours, the colonies may be counted for the quantitative estimate of bacterial density.

The problem of applying the filter to determinations of total bacterial count resolves into a choice of a suitable culture medium, proper incubation, and counting colonies. It is recognized at the outset that not all the living bacteria from a mixed population in a sample of water can be cultivated on a single medium. To quote Prescott, Winslow, and McCrady (*14*): "The customary methods employed to determine the number of bacteria in water do not reveal the total bacterial content, but only a small fraction of it; this becomes apparent when we consider the large number of organisms, nitrifying bacteria, strict anaerobes, etc., which refuse to grow, or grow only very slowly in ordinary culture media, and which, therefore, escape detection. On the one hand, certain obligate parasites cannot thrive in the absence of the rich fluids of the animal body; on the other hand, the prototrophic bacteria, adapted to the task of wrenching energy from nitrates and ammonium compounds, are unable to develop in the presence of the considerable concentration of organic matter contained in ordinary laboratory media."

The following criteria are used as a basis for consideration of media for total counts:

1. The medium should produce a maximum number of colonies from all types of water. The colony yield should compare favorably, where comparisons are possible, with the bacterial counts determined by other methods.

2. The colonies should develop rapidly to a sufficient size to be counted after a minimum incubation period. The present report is concerned with studies of bacterial counts after 18 hours incubation.

3. The medium should be one which is reproducible and is routinely available in laboratories.

In this investigation, bacteria from a number of sources were used in the evaluation of the media. Typical examples were raw Ohio River water, water taken during various stages of treatment processes, or from the distribution system, domestic sewage, and in special instances, a pure culture of *Escherichia coli* suspended in sterile diluting fluid. The pour plate method was used for comparison counts in most procedures where the expected bacterial count was 30 organisms or more per ml. An estimate of the bacterial density in samples containing less than 3,000 organisms per 100 ml. was made by planting five tubes each of at least three decimal dilutions in lactose broth and calculating the most probable number (M.P.N.) based on the presence or absence of growth in each tube. The M.P.N. method was used in all coliform examinations where good laboratory practice would indicate it was applicable.

Samples containing a large number of bacteria were diluted with sterile dilution water to reduce the counts to approximately one organism per ml. Eight liters of bacterial test suspension were prepared for each comparison of media. One hundred ml. of this suspension could be filtered through each membrane with the expectation of a reasonable colony count after incubation. In the comparison of growth-supporting characteristics of media, it is desirable to have between 50 and 150 colonies and not exceeding 300 on each membrane.

The filtration procedure was as follows:

1. A Petri dish (60 mm.×15 mm.) containing a sterile absorbent pad saturated with approximately 2.2 ml. of the medium was placed beside the funnel.

2. One hundred ml. of test suspension were filtered through the sterile membrane in the funnel.

3. The membrane was removed from the funnel with sterile forceps and placed, grid side up, on the absorbent pad, with care so that no air bubbles were trapped between the medium pad and the filter membrane.

4. The Petri dish in an inverted position was incubated for 18 hours at 37° C. in an atmosphere saturated with water vapor.

5. The colonies on the membrane were counted at a magnification of 15 diameters with the ray of light forming an angle of approximately 20° with the membrane surface.

Ten combinations of five different liquid media were compared for

Figure 3. Placing membrane on culture medium.

953081—51——2

growth characteristics on the membranes. These data were obtained by filtering the same quantity of a test suspension through each membrane, making duplicate preparations, incubating for 18 hours at 37° C. in an atmosphere of saturated humidity, and counting the colonies. Table 1 represents the average of three separate evaluations.

Table 1. *Total counts on media by the membrane filter method*

Medium [1]	Average colonies per membrane	Size of colony
Nutrient broth, triple strength	151	Small.[2]
Nutrient broth, double strength	136	Do.[2]
Nutrient broth, single strength	136	Do.[2]
Lactose broth, triple strength	130	Larger.[3]
Lactose broth, double strength	102	Do.[3]
Lactose broth, single strength	110	Do.[3]
Medium A, single strength	91	Do.[3]
Albimi M dextrose, single strength	88	Do.[3]
Albimi M lactose, single strength	85	Do.[3]
M2 Medium, single strength	82	Do.[3]

[1] For compositions of media, see appendix.
[2] Colonies on these plates were typically small. The overwhelming number of the colonies were of pinpoint size.
[3] Colonies on these plates were typically larger. While pinpoint colonies were present, their number was smaller than on the other plates which showed such colonies.

Assuming each membrane had approximately the same density of organisms on the surface, the greatest number of colonies was grown on nutrient broth. The nutrient broth plus lactose resulted in slightly smaller numbers of colonies. The remaining four media were grouped together in third place. Furthermore, triple strength broth, with or without the addition of lactose, appeared superior to the corresponding double or single strength broths. In subsequent experiments, increasing the nutrient broth concentrations to quadruple strength or more failed to increase productivity of the media.

In the evaluation of a medium, the colony size, which depends on speed of growth and accuracy in counting, are practical considerations along with the productivity. The triple strength nutrient broth produced a greater number of colonies, but they were so small that they were difficult to distinguish from sediment or dust particles. On the other hand, colonies on nutrient broth with added lactose were large, easy to count, and apparently grew more rapidly. Therefore, triple strength nutrient broth plus lactose was considered the best general medium in the above group.

A careful examination of the growth on the Albimi M medium indicated that further improvement in this formula was possible. The concentrations of Albimi M peptone and yeast autolysate were

doubled and 0.5 percent lactose was added to the sterile medium. In addition, it had been observed that a large quantity of dipotassium hydrogen phosphate was necessary to secure a final pH 7.0 (after sterilization). This increased the phosphate ion ratio to the other ingredients. This modified medium was made in three separate lots. Each lot was divided in three equal parts. The first part was sterilized without adjusting the hydrogen ion concentration; the second portion was made to a pH 7.0 with potassium hydroxide (10 percent aqueous solution); and the third fraction was adjusted to pH 7.0 with dipotassium hydrogen phosphate solution. All of these media were compared with the standard plate count for productivity, using *E. coli* as a test organism. The average colony count was compared with the average of 10 replicate standard plate counts after using an equal quantity of bacterial suspension on each membrane and making 10 replicate membranes for each medium. The data are summarized in table 2. The standard plate counts were incubated for 24 hours at 37° C. and the membranes were incubated for 18 hours at 35° C. in an atmosphere of saturated humidity.

Table 2. *Comparison of Albimi M medium at pH 6.8 and pH 7.0 with dipotassium hydrogen phosphate and pH 7.0 with potassium hydroxide*

Medium	pH	Colony count	Percent of standard plate count
Nutrient agar plate	--------	93	Reference count in percent:
Albimi M—no pH adjustment	6.8	84	90.3.
Albimi M—phosphate	7.0	71	75.9.
Albimi M—potassium hydroxide.	7.0	86	92.6.

The Albimi M lactose medium at pH 7.0 with potassium hydroxide and the same medium at pH 6.8 without pH adjustment appeared to offer little choice, although the addition of sufficient dipotassium hydrogen phosphate to pH 7.0 resulted in a marked decrease in productivity. Double strength Albimi M medium plus 0.5 percent lactose and adjusted to pH 7.0 with potassium hydroxide has been designated as the medium of choice for total bacterial count procedures in this laboratory. The adjustment to a pH 7.0 with potassium hydroxide solution results in slightly better recovery rates (92.6 percent) and has the added advantage that every lot of medium will have the same hydrogen ion concentration.

Samples from a number of sources were examined following the development of a satisfactory medium for bacterial counts. The same general procedure was used for all samples, but certain changes in the routine method had to be made for each group. For example, waters

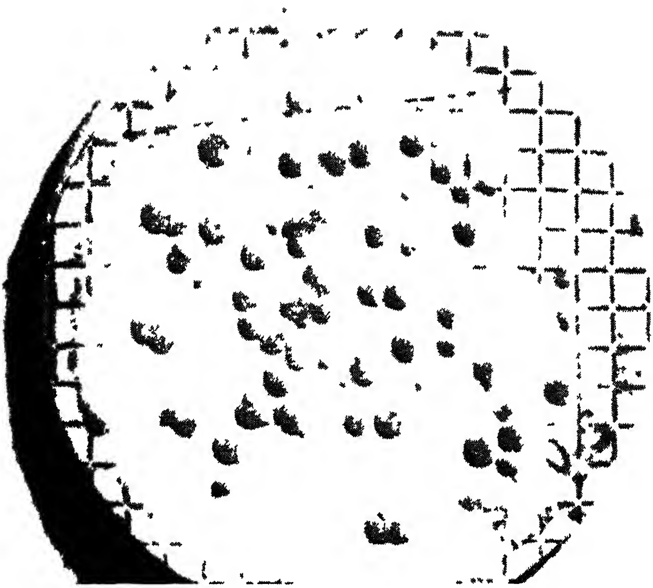

Figure 4. Colonies on Albimi M medium.

with a low bacterial density required samples up to 500 ml. while those with a large bacterial population were diluted with sterile water so that a fraction of an ml. could be examined. The membrane, for most accurate results, should not have in excess of 300 colonies on it. The quantity of each sample was measured to produce an expected colony count of less than 300 and, where an estimate of the bacterial population of the sample was impossible, several membrane counts were prepared by filtering different quantities of the sample. Samples with low bacterial density (less than 30 colonies per ml) could not be compared with a standard plate count and, in such instances, an M.P.N. method (previously described) was used for estimating total bacterial density. When a series of dilutions were made of the sample (Ohio River water or sewage), an appropriate dilution in the series was planted in five replicate plates for an average standard plate count.

The average results of membrane counts with the corresponding average most probable number of bacteria from sample points in the distribution system of several cities are summarized in table 3. All counts are calculated on a unit of 100 ml. of original sample. Fractions of a bacterium are found in the column on membrane counts because the samples examined were greater than 100 ml. The colony count was calculated, for the purpose of comparison, to 100 ml. of water. Bacterial densities were so low that a standard plate count with 1 ml. of sample was unsatisfactory (less than 30 colonies per plate).

Table 3. *Comparison of membrane counts with the M.P.N. method on city water supplies*

Sample point	Colony count on membrane calculated per 100 ml.	M.P.N. (lactose broth) of bacteria at 37° C.—24 hours
	City A	
1	2. 25	1. 7
2	101. 50	540. 0
3	44. 00	240. 0
4	113. 00	79. 0
5	16. 00	13. 0
6	80. 00	11. 0
	City B	
1	443. 00	920 0
	City C	
1	14. 00	14. 0
2	9. 00	3. 1
3	2. 50	2. 3
	City D	
1	113. 00	79. 0
2	117. 00	79. 0
	City E	
1	53. 50	350. 0
2	87. 00	140. 0

There is no common basis of comparison between the membra ount and an M.P.N. count for the total number of bacteria. but i spection of the above data reveals both methods produced comparable counts nine times. The membrane count was more than twice the M.P.N. once and the M.P.N. method was more than twice the membrane count four times.

The membrane technique is applicable to water samples from the distribution system in the estimation of total bacterial density. It can be used for total bacterial density in samples of any quantity up to a liter or more. This is a distinct advantage over the standard plate count. It reduces the time for the test by at least 25 percent and makes even greater reductions in labor, space, and materials.

Water taken during the various stages of treatment in water plants did not give satisfactory membrane preparations. A heavy cake of

sediment which formed on the membranes during the filtration caused the bacterial growth to consist of a spreading mat of ill-defined and uncountable colonies. The examination of samples in the treatment process was limited to water with high initial suspended solids treated with coagulants. The process could probably be used with excellent results in waters that were relatively clear.

Thirteen samples of fresh domestic sewage were examined. It was necessary to filter very small quantities of sewage because of their high bacterial density. Serial dilutions (using 99 ml. sterile water blanks) were prepared to contain 0.0001 ml. of sewage in 100 ml. of water, and the last dilution was filtered through the membrane. The total counts were made by the nutrient agar pour-plate method by planting one ml. of appropriate dilutions. During the latter part of the series, six M.P.N. counts for total bacterial density were added to illustrate the relationship with the standard plate count. The data are presented in table 4 with all counts calculated in density per 100 ml. of sample.

In the samples of domestic sewage tabulated above, the membrane count was higher than the plate count in 9 of the 13 determinations. The plate count averaged 87 percent of the membrane count. Six M.P.N. determinations were included for comparative values. As the membrane count averaged higher than the plate counts in the series, it would indicate that the filtration method is the better procedure for determining total bacterial densities in sewage.

Bacterial Counts—Summary I

The filtration method has a marked advantage over the standard

Table 4. *Membrane counts and standard plate counts on sewage*

Average filter colony count* in millions	Average nutrient agar count* in millions	Ratio of plate count/ filter count	M.P.N in millions
116. 2	80. 4	0. 69	------------
121. 6	87. 8	0. 72	------------
110. 0	74. 0	0. 67	------------
141. 6	78. 0	0. 55	------------
44. 2	51. 4	1. 17	------------
50. 8	57. 6	1. 15	------------
183. 6	120. 8	0. 66	240
102. 2	67. 6	0. 66	28
150. 5	105. 0	0. 63	35
147. 8	128. 8	0. 87	49
178. 3	189. 8	1. 06	350
58. 3	52. 6	0. 90	130
84. 0	85. 4	1. 02	------------

*These average figures are based on five replicate preparations.

plate method for the enumeration of bacteria in samples of low bacterial density. Larger samples of 1,000 ml. or more may be examined by this procedure. The quantity of sample that can be used in a single test is limited to the amount of water that can be passed through the filter and the bacterial density since membranes with more than 300 colonies are not recommended for accuracy. The membrane method offers savings in elapsed time for test, incubator space, equipment, materials, and labor.

Total count data from the distribution systems of municipal water plants demonstrated the value of the membrane method because, in most samples, a one ml. plant on the standard agar plate would have given only a few colonies (less than 30).

The series on domestic sewage furnished a direct comparison between the membrane method and the standard plate count. The filtration procedure gave higher counts than the standard plate count in 9 out of 13 trials (69 percent). It appears that the filtration procedure is probably more productive than the standard plate count and is, at its poorest, equal to it.

The membrane filter is recommended for the counting of bacteria in relatively clear water with high or low bacterial densities and in turbid waters with high bacterial populations. It has not been used successfully so far on samples with extremely high turbidity and very low bacterial density.

Quantitative Estimation of the Coliform Group

The coliform group or one of its members has been used as the indicator of water quality throughout the civilized world. Some disagreements have developed over the significance of the various strains in the coliform group. These same disagreements have resulted in numerous procedures and media for potability tests on water and the investigations of pollution problems. In the United States, the coliform group is used as a pollution indicator, without separation of the fecal and nonfecal strains. Before considering any method for coliform examinations, the aims of an ideal test should be established. The coliform test procedure should:

1. Enumerate all coliforms present in the sample. For example, one organism that is a member of the coliform group should initiate a clear characteristic reaction.

2. The procedure should be specific for members of the coliform group.

3. The method should be rapid. Results should be available in hours rather than the 2 to 5 days now required.

4. The routine test should be simple. Involved methods are avoided or slighted in control procedures and small plants are not equipped to perform such test.

The procedures of Standard Methods are considered to be the nearest approach to the ideal test and, in the evaluation of membrane procedures, this reference test was the standard of comparison.

In the establishment of the membrane procedure for the quantitative estimation of coliforms, numerous types of media were investigated. The major problem in the application of the membrane filter to the identification of groups of organisms such as the coliforms is the development of selective media. Established media quite frequently behave abnormally when they diffuse through a membrane. Comparisons with the agar plate counterpart should be approached with caution.

Preliminary investigations of each medium were made with a water sample containing a member of the coliform group and some non-lactose fermenting organisms. Many unsatisfactory media were discarded after preliminary testing. A modification, presented below, of Endo medium as a broth was found to be most satisfactory.

Endo Broth—E.H.C. Modification

Basal medium

Lactose	20 gm.
Neopeptone (Difco)	20 gm.
K_2HPO_4	7 gm.
Distilled water	1,000 ml.

The constituents were dissolved in the water, using moderate heat if necessary. Medium was adjusted to pH 7.5, using KOH solution. It was tubed in 30 ml. portions, and sterilized in the autoclave for 15 minutes at 121° C.

Sodium sulfite solution

Nine percent aqueous solution of anhydrous Na_2SO_3 was freshly prepared in sterile distilled water.

Basic fuchsin solution

Basic fuchsin	3.0 gm.
Ethyl alcohol	50 ml.

The dye was dissolved in the alcohol, and sufficient distilled water added to make 100 ml. The dye solution was stored in the refrigerator to reduce evaporation of the solvent.

Use of the medium

To one 30 ml. tube of the basal medium was added 1.0 ml. of the sodium sulfite solution and 1.0 ml. of the basic fuchsin solution. It was thoroughly mixed by agitation of the tube, and applied to the blotting pads in 2–2.2 ml. quantity. This medium was used the same day.

Basic fuchsin may differ in dye content from lot to lot and from manufacturer to manufacturer, making it necessary to standardize the proportions of basic fuchsin with each new lot of dye.

The standardization of fuchsin-sulfite proportions by addition of only enough sodium sulfite to decolorize the fuchsin cannot be used with this medium. In standardizing this medium, a number of tubes of the medium with varying amounts of the basic fuchsin were

prepared and one ml. of sulfite solution was added to each tube. The medium was evaluated on the basis of differentiation of coliform organisms and the productivity.

Studies were undertaken with the medium, using pure-culture suspensions of coliform organisms to determine (1) the efficiency of coliform recovery; (2) the optimum incubation period; and (3) the value of preliminary incubation of the inoculated membranes on a non-selective enrichment medium. Following these studies, a series of tests on various polluted waters were undertaken to determine coliform counts in comparison with M.P.N. procedures of Standard Methods. The M.P.N. was based on the "confirmed test" in brilliant green lactose bile broth.

Effect of Preliminary Enrichment on Coliform Productivity

A series of duplicate filtrations of suspensions of *E. coli* were used to compare the productivity of the E.H.C. Endo broth with a preliminary enrichment period. One filter was incubated 16 hours on the Endo medium and the duplicate was cultured for the first 2 hours on Albimi M lactose medium before the filter was transferred to the Endo medium for 14 hours incubation. The counts recorded in table 5 represent the colonies exhibiting the metallic sheen typical of coliforms on the filters.

Table 5. *Growth on membrane filter (E.H.C. Endo broth)—comparison of (a) 2-hour enrichment before transfer, with (b) direct transfer*

Test No.	On Endo medium (no enrichment)	Two-hour enrichment before Endo medium
1	175	225
2	12	45
3	19	62
4	7	64
5	26	53
Average	48	90

The above data demonstrate a significant increase in coliform growth when organisms on the membrane have 2 hours preliminary enrichment on lactose Albimi M medium before being transferred to the Endo medium. Selective media, such as Endo, have a slightly toxic action to all bacteria, which may suppress growth unless the organisms are in an actively growing phase. It is suggested that the increased yield of coliform bacteria (following enrichment) is due to growth being initiated on a rich, nonspecific medium and, after

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growth is started, it survives any unfavorable action of the fuchsin-sulfite combination in the Endo medium.

Preliminary enrichment on Albimi M lactose medium for 2 hours before the membrane is transferred to the Endo medium is essential for careful quantitative determinations of the coliform group.

Productivity of Coliforms on Endo Medium

In this evaluation a pure culture of *E. coli* suspended in sterile dilution water was used as a test organism. Ten replicate filtrations were made and 10 replicate nutrient agar plate control counts were prepared for each of three series. The incubation was 2 hours on Albimi M lactose medium followed by 14 hours on the Endo medium.

Table 6. *Recovery of* E. coli *in suspension by membrane method and standard plate count*

Series	Average coliform count on filter	Average nutrient agar plate count	Index of recovery: $\frac{\text{filter count}}{\text{plate count}}$=index
1	96.0	99.9	0.963
2	79.1	71.7	1.107
3	80.2	78.6	1.022
Average	85.1	80	1.063

Data in table 6 indicate that the growth on the Endo medium (used with the filtration technique) is at least equivalent to coliform growth on nutrient agar plating medium.

The elapsed time for the finished test for coliform examinations has been reduced to a period of hours. Final incubation period for coliform counts on Endo medium by the membrane technique is derived from the data in table 7. Identical samples of water containing a suspension of *E. coli* were filtered through membranes (10 replicate preparations), incubated 2 hours on Albimi M lactose medium and transferred to Endo medium for continued incubation. The total number of colonies and the typical coliform colonies (with metallic sheen) were counted at periods of 10, 13, 16, 19, and 22 hours. This procedure was repeated 5 times.

The *E. coli* colonies grow rapidly on the membrane. There were 100 colonies (90.1 percent) on the filter after a 10-hour incubation period, but, of this number, only 20 percent had developed the typical differential characteristics of a coliform colony. The total colony count, 11, increased slightly in the next 12 hours. During

Table 7. *Incubation period and development of sheen by colonies of* E. coli *(elapsed time including preliminary enrichment)*

Hours of incubation	Total colonies	Typical coliform colonies	Percent of typical coliform colonies
10	100	20	20. 0
13	102	78	76. 4
16	103	96	93. 2
19	107	101	94. 4
22	111	102	91. 9

the same period, many of the colorless colonies were developing the typical metallic sheen of the coliform. These data indicate that the minimum elapsed time for a reasonably quantitative coliform density (93 percent) must be at least 16 hours. There is a possibility of using the shorter incubation period of 10 hours for a qualitative test, but this problem has not been investigated. The minimum time for the coliform estimation may be further reduced through the development of new media.

Coliform densities of domestic sewage were determined comparatively by the M.P.N. procedure and the membrane technique on E.H.C. Endo medium (table 8). The inoculated membranes were first enriched for 2 hours on Albimi M lactose media, then transferred to the Endo medium for 14 hours incubation. Colonies were counted with a magnification of 15 diameters. Counting of coliform colonies was limited to those colonies having metallic sheen since many non-coliform organisms also grown on Endo medium. The M.P.N. pro-

Table 8. *Comparison of coliform counts on E.H.C. Endo medium by membrane method with most probable number by confirmed test*

Sample	Coliform per 100 ml. by—		Sample	Coliform per 100 ml. by—	
	Membrane test (in millions)	Confirmed test (in millions)		Membrane test (in millions)	Confirmed test (in millions)
1	13. 0	11. 0	9	13. 5	13. 0
2	9. 1	17. 0	10	7. 3	3. 3
3	6. 0	17. 0	11	6. 1	33. 0
4	7. 9	7. 0	12	18. 5	22. 0
5	8. 9	2. 3	13	17. 0	13. 0
6	12. 5	23. 0	14	35. 0	49. 0
7	9. 8	4. 9	15	26. 0	79. 0
8	13. 5	23. 0	16	16. 9	33. 0

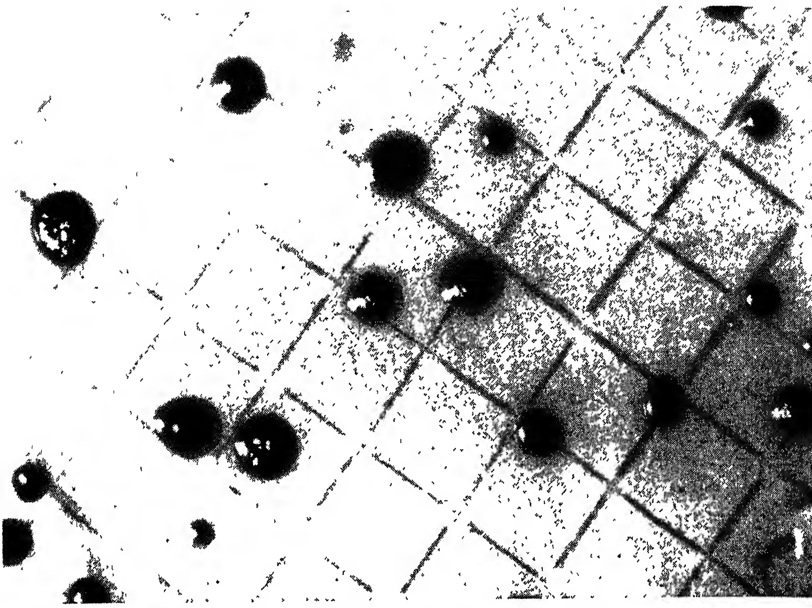

Figure 5. Coliforms on E.H.C. Endo medium.

cedure consisted of planting at least three-decimal dilutions of five tubes each in lactose broth and confirmation of all tubes with gas in brilliant green lactose bile broth. All filter counts were based on an average of five replicate determinations.

Discussion

Out of 16 determinations, the M.P.N. value by confirmed test for the coliform count was higher in 9 cases than the coliform count by the filter technique. In the remaining 7 examinations, the coliform value by the filter technique was higher than that of the M.P.N. determination. The median of the M.P.N. series was 17,000,000 coliforms per 100 ml. of sample, while the median of the membrane filter series was 12,900,000. The membrane filter method with the E.H.C. Endo medium gives coliform densities that are not significantly lower than those obtained by the Standard Method M.P.N. procedure. The M.P.N. values fluctuate over a higher and lower range than do their corresponding values obtained by the membrane procedure. The growth of an organism in a colony on the membrane resembles the development of a colony on a nutrient agar plate. Assuming equivalent productivity of the medium in both methods, the filter procedure would be equal in accuracy to the standard plate count and far superior to the approximation obtained by the M.P.N. method. It would seem that any coliform determination with the membrane filter

technique would have a greater degree of reliability than the M.P.N. coliform determination. Additional advantages favoring the filter procedure are the rapidity of the test and the relative simplicity of the method. While the M.P.N. procedure may require 96 hours to finish the "confirmed test", the filter technique required 16 hours. In the confirmed test, 2 to 4 different observations had to be made and transfers of from 5 to 14 positive lactose tubes to brilliant green lactose bile broth were necessary. On the other hand, in the filter method, after the initial 2-hour period on the enrichment medium, the membranes were transferred to the Endo medium and counted 14 hours later.

The estimation of total bacterial density on waters in various stages of the treatment process was not successful due to the heavy precipitate collected on the membrane. This criticism does not apply to samples examined for coliform density. Table 9 presents data on plant control tests in a municipal plant using sedimentation, iron and lime flocculation, filtration, and chlorination.

Table 9. *Plant control tests by membrane method and confirmed test for coliforms*

Type of sample	Coliforms per 100 ml.							
	Membrane procedure				M P.N. (confirmed test)			
	1	2	3	4	1	2	3	4
Settled river water	1, 400	1, 210	388	1, 488	2, 000	780	780	700
Filter influent	80	93	10	86	<180	68	45	70
Filter effluent	6	1	12	4	13	2	22	13
Filter effluent (chlorinated)	0	0. 08	0	0. 08	<1. 8	2	<1. 8	<1. 8

All membrane filters in the above series were countable. Apparently the Endo medium suppresses spreader formations that were troublesome on the Albimi M lactose medium. The coliform density determined by the filter method was high twice in four trials on river water, high twice in three tests on filter influent, and generally lower in tests on the filter effluent and chlorinated water. However, in the membrane test, a 200 to 500 ml. portion of water was examined, while the M.P.N. was based on a sample of 55.5 ml. (5–10-ml. tubes, 5–1-ml. tubes, and 5–0.1-ml. tubes).

The membrane filter method suggests an adequate test for coliform density in water-plant control. A final answer will depend on the data obtained after trials in different treatment plants with waters of different degrees of pollution, varying chemical composition, and treatment methods.

Coliform Count—Summary II

The application of the membrane filter method to coliform determinations has been reported. A modified Endo broth (Endo Medium-E.H.C. modification) is recommended for coliform differentiation. The technical procedure of filtration and cultivation has been described. Representative experimental data have been included. Advantages of the membrane filter procedure are: large samples; reasonable accuracy; minimum time for testing (16 to 18 hours); and marked reduction in labor, equipment, space, and material.

Culture of *Salmonella typhosa* From Water Samples on a Membrane Filter

Over the years, much time has been expended on efforts to isolate pathogenic organisms from water and sewage. All the methods that have been developed are tedious and laborious. Furthermore, none have been satisfactory as a quantitative, or even a semiquantitative, procedure. The isolation of pathogenic organisms from water supplies is not a routine method for the determination of water quality. In epidemiological investigations, such a procedure would be of particular value in the direct isolation of pathogens from water supplies when the dangerous organism is not associated with the coliform group or other normal environmental indicator organisms.

According to Prescott, Winslow, and McCrady (*14*) methods for the isolation of pathogenic organisms from water must follow one or a combination of more than one of the following general procedures:

1. Cultivation on a differential medium that inhibits or kills unwanted bacteria.
2. Development of characteristic growth which may be easily recognized by visual inspection.
3. Concentration of organisms by filtration, agglutination, or adsorption on physiologically inert precipitates.

Numerous methods have been described for the isolation of *Salmonella typhosa* from blood, urine, and feces. Many of these methods depend on selective or inhibitory media. Typical media used in the cultivation of *S. typhosa* are tetrathionate broth by Müller (*15*), brilliant green Esbach broth recommended by Ruys (*16*), brilliant green eosin agar suggested by Teague and Clurman (*17*), desoxycholate citrate agar proposed by Leifson (*18*), or the bismuth sulphite medium originated by Wilson and Blair (*19*).

Direct cultivation of *S. typhosa* from water is difficult even on one or more of the excellent specialized media because of the small numbers of the pathogen in the limited quantity of sample to be examined. A number of investigators have attempted to overcome this difficulty

by concentration of the bacteria in a large sample of water by filtration through membrane filters. Mueller *(20)* was successful with this type of procedure in her investigation of an epidemic of typhoid fever occurring in Hamburg. She filtered her samples through a nitrocellulose membrane filter and cultivated the typhoid organisms on a modified bismuth-sulfite medium. She reported that all other methods failed.

The method developed in this study consists of a combination of the filtration procedure which removes the organisms from a large sample of water and the subsequent cultivation of the pathogenic organism on bismuth-sulfite broth of Wilson and Blair. A characteristic type of colony growth of *S. typhosa* is obtained on the medium.

The membrane filter technique requires a liquid medium. It was necessary to examine a number of modifications of differential typhoid media for their suitability as to growth-promoting ability, quantitative recovery rates, and differential characteristics of the typhoid colonies. Best results were obtained with a double-strength bismuth-sulfite broth.

The medium used in this procedure was commercial dehydrated bismuth-sulfite broth [1] (without agar). Pure cultures of *S. typhosa* and *E. coli* were used to determine the recovery rates in dilution water dosed with approximately 100 organisms per sample. The *E. coli* strain used in this experiment was found to grow on the membrane impregnated with bismuth-sulfite broth as a black colony 2–3 mm. in diameter with no zoning and less than 25 percent recovery. This dosed-dilution water was filtered through a sterile membrane filter, which was then carefully placed on a sterile absorbent pad saturated with approximately 2 ml. of culture medium. The sterile dish containing the absorbent pad and the membrane filter was incubated at 37° C. in an atmosphere of saturated humidity for 30 hours. Growth was then ready for examination. The results are given in table 10.

After incubation for 30 hours, colonies of *S. typhosa* on the single-strength bismuth-sulfite broth were only 0.5 mm. to 1 mm. in diameter

Table 10. *Recovery of* S. typhosa *on single- and double-strength bismuth-sulfite broth*

Medium	Percent recovery	
	S. typhosa	*E. coli*
Bismuth-sulfite broth (single strength)	57. 2	3. 1
Bismuth-sulfite broth (double strength)	65. 1	12. 3

[1] Difco Laboratories, Detroit, Mich.

and after 48 hours many of the colonies still had not developed the jet-black center or any degree of zoning around the colonies.

The typhoid colonies on the double-strength bismuth-sulfite broth, after 30 hours incubation, appeared as smooth glistening colonies 2–3 mm. in diameter with jet black centers surrounded by a thin clear white border. These colonies were generally surrounded by a black or brownish zone which may be several times the size of the colony. This zoning by reflected light exhibited a distinctly characteristic metallic sheen.

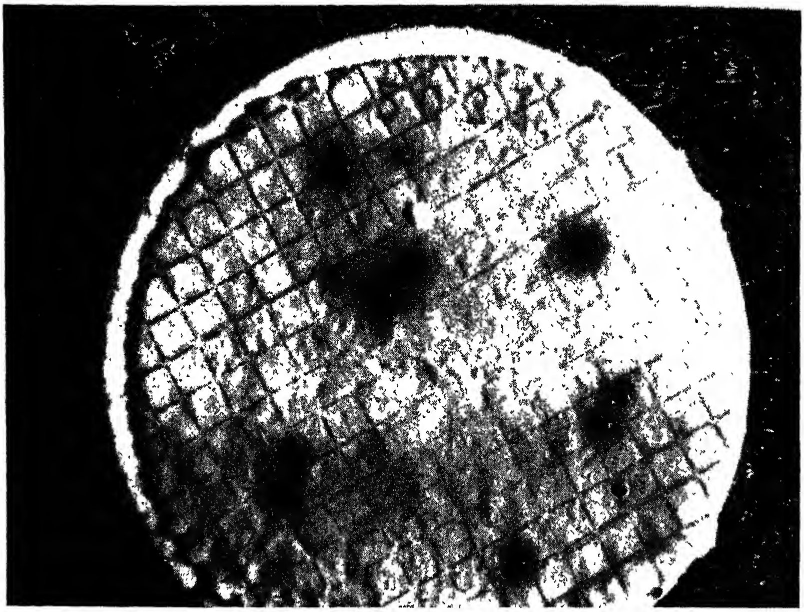

Figure 6. *Salmonella typhosa* on bismuth-sulfite broth.

As a result of this comparative study, the bismuth-sulfite broth was adopted for routine use. It was prepared by dissolving 6.4 gm. (for double strength) of the dehydrated bismuth-sulfite broth in 100 ml. of distilled water and then heating to the boiling point. While heating, the broth was swirled occasionally to aid the formation of the characteristic precipitation. At the first indication of boiling, it was removed from the heat to prevent the selectivity of the medium from being destroyed. The medium was used within 5 hours.

Following the development of a satisfactory medium, a series of nine separate recovery rate studies were made on *S. typhosa* polluted tap water. The lowest density of *S. typhosa* used was 29 per liter and the highest 147. The other seven suspensions had typhoid densities between those two extremes. Albimi M medium was used

Table 11. *Recovery of* S. typhosa *from tap water*

[*S. typhosa* dosed tap water—500 ml. quantities filtered]

Albimi M total count	*S. typhosa* dosage	Percent recovery rate		Percent typhosa of total count	
		Enrichment	No enrichment	Enrichment	No enrichment
425	73. 6	44. 8	47. 6	94. 3	97. 2
85	59. 2	43. 9	54. 1	83. 9	94. 1
115	51. 2	29. 3	44. 9	75. 0	95. 8
45	42. 0	31. 0	57. 1	86. 7	96. 0
45	28. 4	49. 3	38. 7	63. 6	91. 7
10	28. 4	38. 7	49. 2	73. 3	93. 3
5	22. 8	----------	52. 6	----------	92. 3
580	14. 6	41. 1	34. 2	80. 0	100. 0
65	14. 4	55. 6	41. 7	75. 0	83. 3

to determine the total bacterial density; that is, the organisms that grow on the usual laboratory medium. The formula and use of this medium have been described elsewhere in this report.

The enrichment procedure consisted of incubation for 2 hours on the Albimi M medium before the filter membrane was transferred to the selective medium. The data have been summarized in table 11.

Based on nine replicate experiments, the recovery of *S. typhosa* on double-strength bismuth-sulfite broth without enrichment had a median value of 47 percent of the total typhoid density. Of these, a median of 94 percent of the colonies were *S. typhosa.* With 2-hour enrichment on Albimi M medium prior to transferring the membranes to double-strength bismuth-sulfite broth for the remainder of the 30-hour incubation, the median of the total typhoid density dropped to 43 percent. The typhoid colonies were 78 percent of the total number.

A representative number of typical typhoid colonies were cultured on Krumwiede triple sugar agar and lead acetate agar. Of these, 278 colonies showed typical characteristics in both media and one colony appeared to be a member of the coliform group. Seventy-two typical colonies were checked serologically with anti-typhoid agglutination sera, with 69 positive and 3 doubtful.

Occasionally a few colonies from river and sewage samples produced a blackening on double-strength bismuth-sulfite broth, but they failed to be agglutinated by *S. typhosa* antiserum, and gave a typical triple sugar reaction characteristic of the coliform group. Growth of *E. coli* on this medium is described in the Difco Manual (*21*) as follows:

> Coli is usually completely inhibited. Occasionally a strain will be encountered that will develop small black, brown, or greenish glistening surface colonies.

This color is confined entirely to the colony itself and shows no metallic sheen. Likewise a few strains of aerogenes may develop on this medium forming raised, mucoid colonies. These may exhibit a silvery sheen, appreciably lighter in color than that produced by typhoid. . . . There are some members of the coliform group capable of producing hydrogen sulfide that may develop on this medium, giving colonies similar in appearance to typhoid.

It therefore seemed advisable to isolate and identify such organisms as well as to determine their recovery rate on double-strength bismuth-sulfite broth. Five coliforms which produce H_2S were used in this experiment. Each of five 99-ml. samples of sterile water were dosed with approximately 100 organisms. Each dosed dilution was filtered through a membrane and placed on a pad containing 2 ml. of double-strength bismuth-sulfite medium. The pads were then placed in an incubator of saturated humidity at 37° C. Poured nutrient agar plates of each culture were made to determine the amount of suspension filtered onto a membrane. The filtration results plus the Imvic. reactions are summarized in table 12.

Table 12. *Coliform H_2S producers on double-strength bismuth-sulfite broth*

Culture No.	Percent recovery	Indole	M.R.	V. P.	Citrate	Lactose	Colony appearance
Intermediates:							
1–3	00. 0	−	±	+	+	+	No growth.
1–10	62. 1	+	+	−	+	+	Dark brown center with narrow white border, 0.5–2 mm. in diameter, no zoning.
1–48	33. 2	−	+	+	+	+	Dark brown center with narrow white border, 0.5–3 mm. in diameter, no zoning.
Aerogenes: A–37	00. 0	−	−	+	+	+	No growth.
Escherichia: C–30	89. 1	+	+	−	−	+	Dark brown, 1–3 mm. in diameter, no zoning.

The effect of crowding by nontyphoid organisms was investigated. A known suspension of *S. typhosa* was added to different dilutions of sewage containing a known number of coliforms as determined by Endo medium counts for coliforms.

The results in table 13 indicate that the amount of zoning falls off rapidly as the coliform density increases in the water sample.

Salmonella typhosa Culture—Summary III[2]

A method for the rapid isolation of *Salmonella typhosa* from large samples of water has been described. The quantity of sample for

[2] For the convenience of the reader separate summaries are inserted at the conclusion of the sections on bacterial counts and coliform counts.

Table 13. *Recovery of* S. typhosa *from dosed sewage—500 ml. quantities*

Endo medium coliforms	*S. typhosa* dosage	Percent recovery 2x B.S[1] broth	Zoning of *S typhosa*
14, 750	54. 0	22. 4	No zoning.
5, 875	42. 0	17. 0	No zoning.
1, 285	46. 0	15. 1	No zoning.
750	61. 0	26. 3	50 percent zoning.
210	72. 0	38. 9	90 percent zoning.

[1] Double-strength bismuth sulfite.

examination will be restricted only by the amount that will pass through the filter. Precipitate or sediment in the water will clog the filter, but most waters of drinking quality will permit filtration of a liter or more. The procedure has been satisfactory when the minimum density of *S. typhosa* was approximately 10 organisms in the sample, as one-half the bacteria grow on the membrane. Excessive numbers of *S. typhosa* colonies on the membrane are not recommended. It is suggested that the density of *S. typhosa* be less than 100 organisms per sample. *S. typhosa* grew as a characteristic black colony and many other species of bacteria were inhibited. Sulfite-reducing organisms have been found to produce brownish or black colonies. Such colonies may be disregarded and the *S. typhosa* colonies confirmed by serological agglutination or cultural methods.

EDITORIAL NOTE: The experiments reported here, although they indicate at points that counts on the filter have statistical superiority to counts by other methods, are not primarily concerned with these statistical advantages. Experiments concerned primarily with the statistical advantages will be reported in later papers. The present studies suggest that the filter offers great operating advantages while achieving statistical results at least as good as those of other methods.

APPENDIX

Media:

Nutrient broth

Single strength	8 gm. dehydrated broth per liter.
Double strength	16 gm. dehydrated broth per liter.
Triple strength	24 gm. dehydrated broth per liter.

Lactose broths

Nutrient broth in various strengths, plus addition of 0.5 percent lactose.

Media—Continued

Albimi M (single strength)

Albimi M peptone	20 gm.
Yeast autolysate (Albimi)	3 gm.
Dipotassium hydrogen phosphate	1.5 gm.
Sodium chloride	2.5 gm.
Distilled water	1,000 ml.

(Double or triple strengths obtained by increasing dry ingredients.) Sugars may be added in concentration of 0.5 percent.

Medium A

Tryptose (Difco)	40 gm.
Yeast extract (Difco)	10 gm.
Dipotassium hydrogen phosphate	7 gm.
Distilled water	1,000 ml.

M–2 Medium

Albimi M peptone	40 gm.
Yeast autolysate (Albimi)	6 gm.
Dipotassium hydrogen phosphate	3 gm.
Sodium chloride	5 gm
Distilled water	1,000 ml.

Adjust to pH 7 with dipotassium hydrogen phosphate.

Bismuth-sulfite broth

Beef extract	1 gm.
Peptone	2 gm.
Dextrose	1 gm.
Disodium hydrogen phosphate	0.8 gm.
Ferrous sulfate	0.06 gm.
Bismuth-sulfite indicator	1.6 gm.
Brilliant green	0.005 gm.
Water	100 ml.

(Heat to boiling—do not autoclave.)

E.H.C. Endo broth

(See text.)

Sterilization: Autoclave all media for 15 minutes at 121° C., with the exception of the bismuth-sulfite broth.

REFERENCES

(*1*) Bigelow, S., and Gemberling, A.: Collodion membranes. J. Am. Chem. Soc. **29:** 1576–1589 (1907).

(*2*) Ferry, J. D.: Ultrafilter membranes and ultrafiltration. Chem. Rev. **18:** 373–455 (1936).

(*3*) Pierce, H. F.: Nitrocellulose membranes of graded porosities. J. Biol. Chem. **75:** 795–815 (1927).

(*4*) Zsigmondy, R., und Bachman, W.: Ueber neue Filter. Ztschr. F. anorg. chemie. **103:** 119–128 (1918).

(*5*) Zsigmondy, R.: U. S. Patent No. 1,421,341 (June 27, 1922).

(*6*) Goetz, A.: Fiat final report 1312, Joint Intelligence Objective Agency. U. S. Department of Commerce, Washington, D. C. (1947).

(*7*) Goetz, A.: Aerosol filtration with molecular filter membranes. Chem. and Engin. News. **29:** 193 (1951).

(*8*) Goetz, A.: Personal communication.

(*9*) Phillips, C. R.: The sterilizing action of gaseous ethylene oxide. II. Sterilization of contaminated objects with ethylene oxide and related compounds: Time, concentration and temperature relationships. Am. J. Hyg. **50:** 280–288 (1949).

(10) Kaye, S., and Phillips, C. R.: The sterilizing action of gaseous ethylene oxide. IV. The effect of moisture. Am. J. Hyg. **50:** 296–306 (1949).
(11) Phillips, C. R., and Kaye, S.: The sterilizing action of gaseous ethylene oxide. I. Review. Am. J. Hyg. **50:** 270–279 (1949).
(12) Kaye, S.: The sterilizing action of gaseous ethylene oxide. III. The effect of ethylene oxide and related compounds upon bacterial aerosols. Am. J. Hyg. **50:** 289–295 (1949).
(13) Kaye, S.: The use of ethylene oxide for the sterilization of hospital equipment. J. Lab. and Clin. Med. **35:** 823–828 (1950).
(14) Prescott, S. C., Winslow, C.-E. A. and McCrady, M. C.: Water Bacteriology, ed. 6. John Wiley and Sons, Inc., 1945, p. 35.
(15) Müller, L.: Milieux pour la recherche des bacteries du groupe typhodysentérique. Compt. rend. Soc. de biol. **93:** 433–436 (1925).
(16) Ruys, A. C.: Ein brilliantgrün-Medium für die Isolierung von Paratyphus B Bakterien aus Stuhl und Urine. Zentral. Bakt. I. Abt. Orig. **132:** 349–351 (1934).
(17) Teague, O., and Clurman, A. W.: An improved brilliant green culture medium for the isolation of typhoid bacilli from stools. J. Infect. Dis. **18:** 647–652 (1916).
(18) Leifson, E.: New culture media based on sodium desoxycholate for the isolation of intestinal pathogens and for the enumeration of colon bacilli in milk and water. J. Path. and Bact. **40:** 581–599 (1935).
(19) Wilson, W. J., and Blair, E. M. McV.: Use of a glucose bismuth sulfite iron medium for the isolation of *B. typhosus* and *B. proteus*. J. Hyg. (London) **26:** 374–391 (1927).
(20) Mueller, G.: Eine trinkwassergebundene Ruhrepidemie. Zentralbl. Bakt. Abt. I. Orig. **152:** 133–135 (1947).
(21) Difco Manual of Dehydrated Culture and Media Reagents, ed. 8, p. 103.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ending July 7, 1951

Poliomyelitis

For the current week, a total of 407 cases of poliomyelitis was reported which represents an increase of 19 percent over the previous week's figure of 341. For the same week last year, 478 cases were reported. The cumulative total since the seasonal low week is 2,026 as compared with 2,525 for the same period last year, and the cumulative total for the calendar year is 3,239 as compared with 3,656 last year. No section of the country showed a marked increase in cases for the current week as compared with the previous week. In fact, three sections—New England, South Atlantic, and Pacific regions—reported fewer cases.

The two States reporting large numbers last week, namely, Texas with 62 and California with 48, reported fewer cases as shown in the table. Up to and including the week ended June 30, the incidence in Texas has been highest in Nueces and San Patricio Counties, 30 percent of the cases reported in the State. Nearly one-half of the cases during this period occurred in Bexar, Harris, and Tarrant Counties, all of which have large urban populations. In California, there has been no great concentration of cases in any one or group of counties.

In Louisiana, where 30 cases were reported for the current week as compared with 22 for the previous week, 12 occurred in Shreveport. Prior to the current week, about one-third of the cases reported in the State were in the five counties in the extreme northwest part. Additional personnel and equipment have been supplied to Charity Hospital where most of the cases of the area are being treated.

In Oklahoma, poliomyelitis cases reported in June were concentrated in two counties—Oklahoma and Garvin. In Alabama, nearly half of the cases have been in Jefferson County. Colorado showed a sharp increase in incidence from 2 cases reported for the week ended June 30 to 21 for the current week. Information is not available at this writing to indicate where most of these cases were located.

Epidemiological Reports

Tularemia

Dr. D. W. McEnery, Wyoming Department of Public Health, states that of the eight cases of tularemia reported so far this year, one case

gave a history of handling rabbits, one was a person who had been shearing sheep, and one may have become infected while skinning mink. The source of infection was not determined in the remaining five cases.

Human Rabies

Dr. R. H. Hutcheson, Tennessee Commissioner of Health, has reported a tentatively diagnosed case of human rabies in a 4-year-old boy. The child, whose residence was reported to be in Leflore County, Mississippi, was admitted to a hospital in Memphis about May 31 after an illness of about 10 days. A diagnosis of encephalitis was made. He died, and an autopsy was performed on June 3, but sections of the brain were not examined until June 27 when rabies was reported to be the cause of death. The laboratory of the Memphis and Shelby County Health Department reported a tentative diagnosis of rabies on examination of sections of the brain. The family of the child stated they did not know the child had been bitten.

Relapsing Fever

Dr. W. L. Halverson, California Director of Public Health, reports that the first cases of relapsing fever for 1951 were discovered this week. One case was reported by the Long Beach Health Department, while the second, a child 10 years of age, contracted the disease in Eldorado County in the Sierra Nevada Mountains where chipmunks and tamarack squirrels are known reservoirs and the *Ornithodorus hermsi* tick is a known vector.

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	July 7, 1951	July 8, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	1	1	-------	(1)	(1)	(1)	(1)	40	25	29
Diphtheria (055)	37	61	96	27th	4,915	7,399	10,968	2,008	3,128	4,610
Encephalitis, acute infectious (082)	17	15	9	(1)	(1)	(1)	(1)	464	381	243
Influenza (480–483)	272	257	274	30th	129,960	148,719	148,719	115,418	138,135	127,880
Measles (085)	7,042	5,961	5,961	35th	472,162	290,499	561,860	443,461	271,370	526,914
Meningitis, meningococcal (057.0)	52	66	54	37th	3,460	3,258	3,130	2,499	2,345	2,158
Pneumonia (490–493)	730	913	(2)	(1)	(1)	(1)	(1)	43,042	56,222	(2)
Poliomyelitis, acute (080)	407	478	478	11th	2,026	2,525	2,525	3,239	3,656	2,878
Rocky Mountain spotted fever (104)	13	24	20	(1)	(1)	(1)	(1)	[3] 144	192	193
Scarlet fever (050) [4]	493	413	604	32d	67,143	55,169	78,970	51,452	38,730	56,426
Smallpox (084)	-------	-------	-------	35th	15	43	66	7	23	45
Tularemia (059)	10	19	19	(1)	(1)	(1)	(1)	358	530	539
Typhoid and paratyphoid fever (040,041) [5]	44	84	90	11th	729	998	1,027	1,164	1,506	1,512
Whooping cough (056)	1,083	2,534	1,648	39th	62,031	93,245	82,489	40,429	71,739	51,223

[1] Not computed. [2] Data not available. [3] Addition: Virginia, week ended June 30, 1 case.
[4] Including cases reported as streptococcal sore throat. [5] Including cases reported as salmonellosis.

Reported Cases of Selected Communicable Diseases: United States, Week Ended July 7, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**37**	**17**	**272**	**7,042**	**52**	**730**	**407**
New England	**2**	**1**	-	**584**	**3**	**18**	**11**
Maine	-	-	-	101	-	1	-
New Hampshire	-	-	-	4	-	2	-
Vermont	-	-	-	26	-	-	1
Massachusetts	2	1	-	351	1	-	5
Rhode Island	-	-	-	24	-	-	-
Connecticut	-	-	-	78	2	15	5
Middle Atlantic	**3**	**7**	**1**	**1,748**	**6**	**52**	**29**
New York	2	4	(1)	970	4	-	17
New Jersey	-	3	1	439	1	21	5
Pennsylvania	1	-	-	339	1	31	7
East North Central	-	**5**	**3**	**1,756**	**10**	**61**	**59**
Ohio	-	-	-	392	3	-	7
Indiana	-	-	-	34	1	5	3
Illinois	-	-	2	278	3	40	16
Michigan	-	5	1	142	2	16	21
Wisconsin	-	-	-	910	1	-	12
West North Central	**2**	-	**8**	**369**	**8**	**122**	**24**
Minnesota	-	-	1	26	2	6	4
Iowa	-	-	-	82	-	3	-
Missouri	2	-	1	101	4	-	6
North Dakota	-	-	4	58	-	106	1
South Dakota	-	-	-	10	-	-	1
Nebraska	-	-	-	15	1	-	7
Kansas	-	-	2	77	1	7	5
South Atlantic	**3**	-	**146**	**795**	**15**	**191**	**41**
Delaware	-	-	1	20	-	-	1
Maryland	-	-	2	297	1	23	1
District of Columbia	-	-	-	17	-	9	3
Virginia	1	-	78	273	1	27	2
West Virginia	-	-	-	31	1	-	1
North Carolina	2	-	-	24	1	-	6
South Carolina	-	-	3	28	1	4	3
Georgia	-	-	62	67	7	128	14
Florida	-	-	-	38	3	-	10
East South Central	**5**	-	-	**130**	**2**	**56**	**43**
Kentucky	1	-	-	38	-	3	-
Tennessee	2	-	-	48	1	-	4
Alabama	2	-	-	42	1	44	22
Mississippi	-	-	-	2	-	9	17
West South Central	**11**	**3**	**59**	**403**	**6**	**146**	**124**
Arkansas	-	-	47	46	-	21	15
Louisiana	-	-	-	7	-	7	30
Oklahoma	-	1	12	21	3	10	21
Texas	11	2	-	329	3	108	58
Mountain	**2**	-	**50**	**267**	-	**32**	**33**
Montana	1	-	-	53	-	-	-
Idaho	-	-	-	40	-	-	-
Wyoming	-	-	-	17	-	-	1
Colorado	1	-	11	23	-	23	21
New Mexico	-	-	-	17	-	2	2
Arizona	-	-	39	62	-	7	7
Utah	-	-	-	55	-	-	2
Nevada	-	-	-	-	-	-	-
Pacific	**9**	**1**	**5**	**990**	**2**	**52**	**43**
Washington	2	-	3	83	-	2	2
Oregon	3	-	1	213	-	16	2
California	4	1	1	694	2	34	39
Alaska	-	-	-	-	-	-	-
Hawaii	-	-	-	30	-	1	-

[1] New York City only.
Anthrax: Pennsylvania, 1 case.

Reported Cases of Selected Communicable Diseases: United States, Week Ended July 7, 1951—Continued

[Numbers under disease are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	13	493		10	44	1,083	126
New England		52			2	35	
Maine						8	
New Hampshire		3					
Vermont		1				9	
Massachusetts		46				16	
Rhode Island		1					
Connecticut		1			2	2	
Middle Atlantic	1	108		1	5	96	9
New York	1	63		1	1	33	5
New Jersey		13				29	
Pennsylvania		32			4	34	4
East North Central		126		2	5	155	14
Ohio		30			1	31	3
Indiana		7			2	19	6
Illinois		19		2		24	4
Michigan		50			1	33	1
Wisconsin		20			1	48	
West North Central		21			2	64	16
Minnesota		4				1	3
Iowa		2			1	13	5
Missouri		2			1	13	7
North Dakota		4				2	
South Dakota		1				1	
Nebraska		3				4	
Kansas		5				30	1
South Atlantic	6	30		1	8	131	18
Delaware							
Maryland	3	7			2	1	
District of Columbia		2					
Virginia	1	2			1	19	6
West Virginia		2					1
North Carolina	1	6			1	45	
South Carolina		1				4	5
Georgia	1	6		1	4	41	6
Florida		4				21	
East South Central		21			2	74	37
Kentucky		4				10	20
Tennessee		10			1	39	4
Alabama		4			1	14	7
Mississippi		3				11	6
West South Central		30		5	14	346	31
Arkansas		1		4	3	30	1
Louisiana		3		1	4	2	
Oklahoma					2	17	3
Texas		26			5	297	27
Mountain	6	17		1	1	119	1
Montana	1	1				10	
Idaho		5			1	22	
Wyoming	2					2	
Colorado		3				32	
New Mexico						3	
Arizona		5				42	1
Utah	3	3		1		8	
Nevada							
Pacific		88			5	63	
Washington		7				19	
Oregon		5				3	
California		76			5	41	
Alaska		1					
Hawaii							

[1] Including cases reported as streptococcal sore throat. [2] Including cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended June 16, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	3					2	1				
Chickenpox	1,095	6		41	8	113	579	51	31	117	149
Diphtheria	1	1									
Dysentery, bacillary	3					3					
Encephalitis, infectious	1						1				
German measles	491			66		80	201		5	50	89
Influenza	34			28	3		1	2			
Measles	1,274	3		80	32	249	336	56	53	344	121
Meningitis, meningococcal	7					1	3	3			
Mumps	663	8		15		215	267	27	51	36	44
Poliomyelitis	6					2	4				
Scarlet fever	297	1		2		69	35	48	18	53	71
Tuberculosis (all forms)	274	13		3	44	114	26	31	3	8	32
Typhoid and paratyphoid fever	25					21	1				3
Venereal diseases.											
Gonorrhea	291	7		6	3	58	55	16	29	29	88
Syphilis	80	2		9	3	38	7	2	8	2	9
Primary	8			1			1		3	2	1
Secondary	2						1		1		
Other	70	2		8	3	38	5	2	4		8
Other forms	1										1
Whooping cough	113				1	24	42	4	1	23	18

FINLAND

Reported Cases of Certain Diseases—May 1951

Disease	Cases	Disease	Cases
Diphtheria	56	Scarlet fever	2,219
Dysentery	5	Typhoid fever	2
Meningitis, meningococcal	6	Venereal diseases.	
Paratyphoid fever	53	Gonorrhea	476
Poliomyelitis	8	Syphilis	15

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

The following tables are not complete or final for the list of countries included or for the figures given. Since many of the figures are from weekly reports, the accumulated totals are for approximate dates.

CHOLERA

(Cases)

Place	January-April 1951	May 1951	June 1951—week ended—				
			2	9	16	23	30
ASIA							
Burma	1,113	320	62	26	25	9	
Akyab	7						
Bassein	228	120	5	4	5		
Mergui		106	14	11	6	2	
Moulmein	168	47	25	7	8	7	
Rangoon	22	10					

CHOLERA—*Continued*

Place	January-April 1951	May 1951	June 1952—week ended— 2	9	16	23	30
ASIA—continued							
India	35,952	6,348	2,086	2,061	1,856	[1] 850	
Bombay	3						
Calcutta	2,088	1,157	256	233	222	182	
Cuddalore	7						
Lucknow		3	3	8	1		
Madras	144	62	39	21	17	9	
Nagpur	68		1	8	1		
Negapatam	87						
Trichinopoly	100	5	2		3		
Tuticorin	34						
India (French):							
Karikal	36						
Pondicherry	143	5					
Indochina.							
Cambodia	[2] 39	[3] 4		[3] 3	[3] 6		
Viet Nam	19	4	2	1	1		
Cantho		2					
Haiphong	3						
Soc Trang	2				1		
Pakistan	9,267	2,615	[1] 119	[1] 37	[1] 15		
Chittagong	26	16	4		2		
Dacca	46	5					
Thailand	1						

[1] Preliminary. [2] Includes imported cases. [3] Suspected.

PLAGUE

(Cases)

Place	January-April 1951	May 1951	June 2	9	16	23	30
AFRICA							
Belgian Congo	12	5		1			
Stanleyville Province	12	5					
British East Africa:							
Tanganyika	[1] 42						
Madagascar	127	4			1		
Union of South Africa	13						
Orange Free State	13						
ASIA							
Burma	235	11	1		1		
Rangoon	[2] 1						
Tavoy	2						
India	5,673	281	[3] 41	[3] 13	[3] 10	[3] 26	
Allahabad	[2] 109	[2] 17	[2] 1	[2] 1			
Bombay	1						
Calcutta	16	4					
Cawnpore	8						
Lucknow	15						
Nagpur	11						
Indochina:							
Cambodia	7	19	10	1			
Pnom Penh	7		2	1			
Viet Nam	45	28	2	4			
Baria				2			
Cap St. Jaques			1				
Phanthiet	24	18	1	2			
Phu Kok Island	9	10					
Indonesia:							
Java	5						
Bandoeng	1						
Djakarta	[2] 1						
Jogjakarta	2						
Semarang	[2] 1						
Madura	12						
Timbang	12						
Thailand	7						
SOUTH AMERICA							
Brazil	4						
Ceara State	4						
Ecuador	14						
Chimborazo Province	8						
Loja Province	6						

[1] Includes suspected cases. [2] Imported. [3] Preliminary figure.

SMALLPOX

(Cases)

Place	January–April 1951	May 1951	June 1951—week ended— 2	9	16	23	30
AFRICA							
Algeria	44	2					
Bechuanaland	127						
Belgian Congo	933	213	67	30	30		
British East Africa:							
Kenya	2						
Nyasaland	36	4			7		
Tanganyika	145	102					
Uganda	10	5					
Cameroon (British)	5						
Cameroon (French)	83	54			[1] 23	[2] 15	
Egypt	1						
Ethiopia	8	2					
French Equatorial Africa	88	1					
French West Africa	1,975	237			116	161	
Dahomey	340	19			[1] 7	[2] 1	
Guinea	9					[2] 1	
Ivory Coast	182	27			[1] 2	[2] 4	
Mauritania	6	7			[1] 2	[2] 1	
Niger Territory	738	36			[1] 4	[2] 54	
Senegal	3					[2] 1	
Sudan	497	130			[1] 82	[2] 87	
Upper Volta	200	18			[1] 19	[2] 12	
Gambia	1						
Gold Coast	333	4					
Morocco (French)	6						
Mozambique	88	9	3				
Nigeria	4,809				2		
Rhodesia:							
Northern		1		1			
Southern	253						
Sierra Leone	23						
Sudan (Anglo-Egyptian)	18			4			
Togo (French)	30	5					
Tunisia	3	2					
Union of South Africa	349	1					
ASIA							
Afghanistan	233	66					
Arabia	3						
Aden	[3] 2						
Oman	1						
Burma	560	22	4	4	7		
Ceylon	11	33	2				4
China	4						
India	161,094	24,051	[4] 5,589	[4] 4,299	[4] 3,789	[4] 1,836	
India (French)	2,085	199	50	20	29		
India (Portuguese)	115	25					
Indochina:							
Cambodia	75	3			2	17	
Viet Nam	434	528	73	85	69	58	
Indonesia:							
Borneo	1,083	19					
Java	131	14					
Iran	228	11	5	5			
Iraq	121	13		16	1	8	1
Japan	52		1				
Korea	474						
Pakistan	27,377	5,458	498	[4] 22	[4] 171	[4] 5	
Straits Settlements	1						
Syria			1				
Thailand	33						
Turkey	[5] 120						
EUROPE							
Great Britain:							
England: **Brighton**	15						
Portugal	9						
Netherlands		52	1				1
SOUTH AMERICA							
Brazil	3						
British Guiana	11						
Colombia	25						
Equador	107	2					
Paraguay	20						
Venezuela	41						

[1] June 1-10, 1951. [2] June 11-20, 1951. [3] Imported. [4] Preliminary figure. [5] Corrected figure.

TYPHUS FEVER *

(Cases)

Place	January-April 1951	May 1951	June 1951—week ended—				
			2	9	16	23	30
AFRICA							
Algeria	39	11					
Belgian Congo	1						
British East Africa:							
Kenya	9						
Somaliland	1						
Uganda	2	2					
Zanzibar		1					
Egypt	60	8	1				
Eritrea	9	4					
Ethiopia	287	48					
Gold Coast	2						
Libya:							
Cyrenaica	1	2		1	1		
Tripolitania	7	3					
Morocco (French)	2						
Morocco (Spanish)	12						
Nigeria	1						
Tunisia	11	4		1			
Union of South Africa	24						
ASIA							
Afghanistan	289	79					
Ceylon	2	1					
India	46	15	5	4	2	4	
India (Portuguese)	30	2					
Indochina: Viet Nam	25	6					
Iran	195	20	8		12	5	
Iraq	27	10	3	1	2	3	
Israel	2						
Japan	10						
Korea	72						
Pakistan	11	2					
Syria	1						
Transjordan	39	3	1			1	
Turkey	76	17	1	2	10	5	2
EUROPE							
Germany (French Zone)			1				
Great Britain:							
Island of Malta	1						
Portugal	28						
Sicily	5						
Spain		1					
Yugoslavia	224						
NORTH AMERICA							
Costa Rica	[1] 5						
Guatemala	11						
El Salvador	[1] 4						
Jamaica	[1] 6	[1] 2					
Mexico	[2] 40						
Puerto Rico	1						
SOUTH AMERICA							
Chile	62	11	4		3	4	
Colombia	32						
Ecuador	[2] 312						
Paraguay	11						
Venezuela	[1] 9		1				

*Reports from some areas are probably murine type, while others include both murine and louse-borne types.
[1] Murine.
[2] Includes murine type.

YELLOW FEVER

(C—cases, D—deaths)

Place		January-April 1951	May 1951	June 1951—week ended—				
				2	9	16	23	30
AFRICA								
Gold Coast	C	[1] 21	[1] 6				[2] 1	
Accra	C	[1] 4						
Adeiso	C	[1] 6						
Sierra Leone	C	[2] 2						
Koinadugu District	C	[2] 2						
Freetown	C	[2] 2						
NORTH AMERICA								
Panama	C	1						
Bocas Del Torro Province	C	1						
SOUTH AMERICA								
Brazil	D	[3] 400						
Goiaz State	D	[3] 400						
Anapoli	D	[4] 1						
Goiania	D	[4] 2						
Goiaz	D	[4] 5						
Inhumas	D	[4] 1						
Jaraqua	D	[4] 6						
Mineiros	D	[4] 2						
Niquelandia	D	[4] 3						
Pirenopolis	D	[4] 1						
Porangatu	D	[4] 1						
Rio Verde	D	[4] 2						
Uruacu	D	[4] 2						
Matto Grosso State	D	3						
Colombia	D	13						
Boyaca Department	D	1						
Otanche	D	1						
Caqueta Commissary	D	2						
Montanita	D	1						
Meta Territory	D	1						
North Santander Department	D	3						
La Vega	D	3						
Santander Department	D	6						
Campohermoso	D	1						
Guamales	D	1						
Maradales	D	1						
Tambo Redondo	D	1						
Venegas	D	1						
Ecuador	C	61						
Esmeraldas Province	D	1						
Atacames	D	1						
Quininde	D	1						
Santo Domingo de Los Colorados	C	58						
San Meguel	D	1						
Peru	D	4						
Huanuco Department	D	1						
Junin Department	D	1						
Loreto Department	D	1						
San Martin Department	D	1						

[1] Includes suspected cases. [2] Suspected. [3] The number of deaths Dec. 1-Feb. 20, 1951, was estimated to be 400 and the number of cases was estimated to be 2,000. [4] Confirmed deaths.

U S GOVERNMENT PRINTING OFFICE: 1951

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price per year—$4.75, domestic; $6.25, foreign.

Public Health Reports

VOLUME 66 AUGUST 3, 1951 NUMBER 31

TUBERCULOSIS CONTROL ISSUE NO. 66

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This is the sixty-sixth of a series of special issues of PUBLIC HEALTH REPORTS devoted exclusively to tuberculosis control. The special issues began March 1, 1946, and appear the first week of each month. The articles are reprinted as extracts. Effective with the July 5, 1946, issue, these extracts may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents a single copy. Subscriptions are obtainable at $1.00 per year, $1.25 foreign.

Public Health Reports

Vol, 66 • AUGUST 3, 1951 • *No. 31*

Medical Social Service in a Tuberculosis Sanatorium

By PAULINE MILLER, A. M.*

Editor's Note: This article is being printed in two parts. The second part will appear in the next Tuberculosis Control Issue, No. 67, September 7, 1951. Later, the article will be reprinted as one publication.

Workers in tuberculosis control—physicians, public health nurses, social workers—are faced daily by a complexity of problems whenever they attempt to arrange hospitalization for patients who have a diagnosis of active tuberculosis. In a particular instance, several members of the health department may have participated in the diagnostic study. They may have referred the patient to appropriate social agencies, and they will have helped determine legal residence and ability to pay for hospital care and arrange for transportation, before the final decision that on a given day the patient will enter a sanatorium. Once the patient actually starts forth in car or ambulance on the trip to the sanatorium, these workers may well breathe a sigh of relief, for the patient has been given new opportunity to regain his health and he is also no longer a source of infection to his family and community.

For the patient, the road that leads to the sanatorium is a new beginning; it leads to an experience different from any he has ever known, one that precipitates him into living in a new place under restrictions that may feel limiting or, on the contrary, may seem properly protective to him. The sanatorium offers each patient two major opportunities essential in the treatment of tuberculosis: first, medical care—not alone the knowledge and skill of doctors and surgeons, and of nurses and X-ray technicians, but also the resources and equipment of pharmacy and laboratory and of related services; and second, an environment conducive to rest, by reason of the regularity of routine, the isolation from demands and pressures of

*Psychiatric case-work supervisor, Lasker Child Guidance Center, Jerusalem, Israel. At the time this paper was written Miss Miller was a special consultant to the Medical Social Section, Division of Tuberculosis, Public Health Service.

family and job, and frequently the physical beauty of the grounds and the stillness of the place. Under the best conditions, this environment is conducive also to some inner quiet.

While the sanatorium offers the patient medical care and quiet and removal from immediate demands of the outside world, it in turn makes certain demands of him with which he must come to terms in his own way. He must learn to live within medical regulations; he must learn to accept some restrictions that are necessary because he is living in an institution and in a group; and he must learn to live within the limits of energy which his illness imposes on him. The patient must also learn that the sanatorium is something different from and more than a hospital, though it is that too; and something different from and more than a custodial institution, though, for a small number of patients it must serve as a custodial institution as well.

These aspects of sanatorium living will impinge in varying ways upon the patient and, influenced by his needs and feelings of the moment, he will accept them as opportunities or resent them as arbitrary, authoritative restrictions. The experience of undergoing treatment in the sanatorium can help develop dependency and invalidism, resulting in unduly prolonged and recurrent hospitalization or in years of care at home that are burdensome to the patient, his family, and the community. The patient, in other words, may use this experience negatively. Or he may find that, despite all of its pain and frustration, the stay in the sanatorium may result in new self-understanding, discipline, maturity, and a realistic acceptance of limitations.

Through this experience of illness he will almost certainly work out a new relationship to himself. If he has never taken time to know himself, he is almost inevitably forced to that preoccupatio now. If he has never thought much about his values in living, no he must almost surely begin to sift them out and make decisions fo himself. He may try either to drop his burdens completely or to maintain full control of his affairs from his hospital bed. Whether he wants health or even life itself enough to put his full energy and capacity into getting well, or whether he is so indifferent to living that he will spend himself in evading medical recommendations, is the all-important choice for each individual patient. The patient's personal answer to this question will determine whether he uses the sanatorium for regaining health, and whether, in fact, he stays in it until he can go out under medical advice and take his place in the community again.

What use he makes of the experience is important not to the patient alone but to the community, which is interested not only in the welfare of the individual patient but, of necessity, in tuberculosis control in

the community. For despite our large resources of medical knowledge, nursing and laboratory techniques, the control program can be defeated in large part unless each patient with active tuberculosis can mobilize himself to undergo the long-drawn-out process of first regaining health and after discharge of continuing to live in a disciplined fashion. If it requires self-discipline and a goal of well-being to get well, to remain well after leaving the sanatorium requires equal determination, self-control, balance of judgment, and capacity to use medical help fully.

Patients by and large come into a sanatorium with the avowed purpose of regaining their health as soon as possible. They have obviously been deterred from this purpose when they walk out against medical advice, when they indulge in careless or even willful disregard of medical recommendations, or when they are reluctant to leave when discharged.

A persistent question in treatment for tuberculosis is what the individual has to cope with, in himself and in his relationships, that may interfere with his medical plan and progress. Will he himself help or hinder the efforts of the medical staff and nurses in the management of his tuberculosis? Can the new patient take what he must live through in the months ahead in adjusting to a new setting and regime, in physical setbacks and uncertainties, in discomfort and pain, in a dependency role which he must accept? Can he bear the changes in family living and shifts in relationships, subtle or gross, temporary or permanent? Will he be able to resist the pull to settle into the sanatorium as a total way of life; will he be able to retain his intent of getting well and be prepared to accept discharge with readiness to pick up living on the outside in a mature and responsible way? What, in short, is the emotional pattern of the individual, the personality of the "patient as a person" with whom we are working?

War, mental ill health, and tuberculosis are among major crises which result in family separation, and each of them takes its toll in the uprooting of children, in financial stress, and in broken homes. The hurt and tear of separation for both parent and child, the shifting of children from "home" to "home," the failure of plans made for the care of children especially when the mother is the sick person, again and again deter patients from continued stay in the sanatorium. "What good will it do for me to regain my health," patients ask again and again, "if in the meantime my wife breaks down because she is carrying too much responsibility," or "If I lose my wife," "If I have no family to go to"; "If I have no home when I get out"? Long continued family separation sometimes precipitates a break in a relation that would have remained intact, weathering lesser storms, without this added strain.

What sustains these people through so much longing and isolation

and fearfulness was the question that recurred most often to the writer as she worked with patients in the sanatorium and felt the heavy weight of their social and emotional problems. It must be kept in mind that the sanatorium not only serves the needs of the patient, it also serves the community's needs in isolating the patient from others. The community asks the person ill with tuberculosis to take on a social burden—protecting others from his illness—often at great cost to himself, the price of separation from family and associates and from the setting which is familiar to him. In the individual case, the patient's home may well offer full opportunity for treatment, yet the patient must learn to put aside his own desires and personal preference because to remain at home jeopardizes the health of his family and of others who may come in contact with him.

Can we anticipate the phases of living in the sanatorium and the kinds of personal circumstance which will present problems to the individual and on which his determination will flounder or be undermined? Do we have at hand knowledge and techniques to help patients learn to use their experience in the sanatorium constructively? Can we put anything into the program of tuberculosis management to accelerate the process of adjustment to sanatorium living, to minimize its negative aspects, and to convert aggressions to purposeful motivation in treatment? Can we help patients find relaxation of spirit in the face of the reality of illness?

This paper will direct itself to these questions. We propose to follow a few patients into the sanatorium, to see them in process of accepting treatment there. We will study the role of medical social work in assisting the doctor and in helping the patient accept the medical program prescribed for him. The paper will be limited to adult patients, not without full recognition that an equally detailed study of children as patients in a sanatorium is long overdue.

The writer recognizes throughout that the determination and movement toward a goal of well-being is individual. But people who stand in varied relationships to the patient play a part in sustaining him in his goal, chief among them, of course, those persons to whom he is closest in affectional ties. They as well as the patient at times need practical and psychological help in what they have to live through by reason of his tuberculosis. For in tuberculosis, the goal of well-being is elusive, and the patient must often follow a long and tortuous path in which he may well lose his way.

We shall try to show how the social worker meets the individual where he is in his feeling, and lets him establish himself in the sanatorium in his full stature as a human being, capable of drawing upon all of his capacities in the process of recovery or, if need be, in the process of accepting death. "I am not an ordinary man," said a critically ill patient as the social worker sat at his bedside the day of

his admission. Reaching out to her, he wanted recognition not as a sick and dying man but as a complete human being unique in his individuality.

In presenting characteristic individual and family circumstances that bear upon the patient's capacity to undergo treatment—circumstances that are entirely familiar to every doctor, nurse or social worker—it is recognized that the problems themselves are less significant than the patient's response to them and to his illness. We will attempt to offer a picture of the interrelationship of social and emotional factors with the medical condition of the individual patient.

The Setting

The material presented in this paper as well as the generalizations specific to medical social work with patients in a tuberculosis sanatorium are drawn from the writer's experience in working as a medical social worker in a sanatorium serving a metropolitan area of approximately 800,000. The sanatorium was located 15 miles from the center of the city it served, and was therefore relatively accessible to families of patients, although special busses going directly to and from the sanatorium were provided by the bus company only on three visiting days a week.

Medical standards in the sanatorium are maintained at a high level. Under the supervision of an excellent medical staff there is an active program of collapse therapy, including surgery, and chemotherapy, and the use of specialized consultation services in all phases of medicine. Psychiatric consultation is increasingly available but is primarily for purposes of diagnosis and disposition rather than for treatment of patients who will remain in the sanatorium.

The period of service to patients covered in this paper is from [illegible]y 1, 1947, to June 30, 1950. This includes a period in which a [illegible]mmunity-wide X-ray survey was conducted in the community served by the sanatorium, under the joint auspices of the local tuberculosis association, the city health department, and the U. S. Public Health Service. While the survey itself covered only 6 months, some of the continuing effects of the survey in the lives of individual patients are evident throughout the 3-year period which the paper covers.

With one medical social worker on the staff serving a sanatorium of 600 patients, the work done with individual patients was partially in the nature of demonstration. In presenting some of the representative case situations in the next sections the writer is keenly aware of the patients whose needs were fully as great as these and whom she nevertheless failed to reach. The material presented here is given with as much fidelity to the facts as the limitations of space and protection of the identity of the patients permit. With the same

concern further to safeguard the patients' identity, the sanatorium is not named in the article.

Emotional Adjustments

Both the patient who says, "Another day, certainly another week here, and I will go out of my mind," and the patient who says, "I have never known such peace of mind as I have found here; I am afraid to go out and lose all this,"—throw into sharp relief the emotional problems with which patients struggle in the effort to regain health in the sanatorium. Patients who cannot bear their inactivity or their separation from home and community life, and patients who sink into the sanatorium because they are overwhelmed by their outside responsibilities can fail to make the kinds of emotional adjustments demanded to undergo treatment in the sanatorium. These two extremes of attitude represent a failure in adjustment which fosters tendencies to leave the sanatorium too soon or to remain too long.

What pitfalls along the way lead to these failures in adjustment? Can we not anticipate the pitfalls, and stand ready to help patients over them?

One could go so far as to draw a chart of emotional reactions and experiences commonly encountered by patients in a sanatorium. All persons who are told they have tuberculosis must come to know the meaning of this illness to them and make some adjustment to it as a reality in their lives. All patients who decide to come into a sanatorium for treatment must make major adjustments to a changed living situation for themselves, in large part relinquishing relationships and habits specific to their home setting and adapting themselves to new demands and ways prescribed by medical regulations and sanatorium living. All patients will need to find their own solutions in accepting or fighting dependency. Illness itself and living in the sanatorium require the patient to allow others to meet personal and physical needs that he has largely met for himself since infancy. Probably all patients will feel the temptation to shut out responsibility and sink into chronic invalidism, a tendency nurtured alike by their illness and its treatment which emphasizes rest, and by the institutional life of the sanatorium. Many of them will struggle to withhold themselves from this tendency. Many patients will have to face recommendations regarding surgery and other medical procedures which are painful or otherwise distasteful. In the course of time many will encounter emotional crises in personal relationships, because illness and family separation and the passage of time itself change social and economic circumstance. And most patients will find themselves somewhat in conflict at the point of leaving the sanatorium, unsure of themselves as they go out to resume responsibilities which they have left for so long.

This section will consider these emotional problems and we shall leave to later sections the specific detail of patients with financial problems and of those with problems of child care.

Acceptance of the Diagnosis

With a diagnosis of tuberculosis, the patient does not thereby cease to be the person that he was. If anything, he becomes more deeply himself at this time of crisis, as he mobilizes himself in defense against this threat to his life, responding to the crisis in ways that are characteristic and peculiar to him.[1] Because in the not-too-distant past the outcome of tuberculosis was so frequently fatal, the response of persons confronted with the fact that they have tuberculosis is still one of alarm. The entire self is alerted to danger and responds in fear. Dependent on the individual's basic and characteristic ways of meeting threat and on his fundamental feelings about living and dying are the impulsive reactions of flight and withdrawal, or of aggression and hostility.

In the first moments and days of knowledge of his diagnosis, when he may well withdraw into himself with his feeling still amorphous, the patient may find himself incapable of decision and action. He tends, rather, to examine past behavior and habits over and over again, reviewing such conduct as keeping late hours, working hard to achieve some too-earnestly pursued personal goal, indulging in excessive drinking to compensate for persistent fatigue. In fact he goes over and over all the detail of daily habits and relationships to see what in his background could have led to breakdown from tuberculosis and what he might have done to avoid the illness that he has acquired.

By the time the patient is admitted to the sanitorium, he has lived a little with his knowledge that he has tuberculosis and he may have worked through his initial response of incredulity, anger and shock that this could happen to him. He may, as often happens, come into the sanitorium determined to forget or negate the full implications of his tuberculosis, determined to take his illness in the tradition of good sportsmanship. If one can penetrate the attitudes of dignity, devil-may-care casualness, or surface sportsmanship, and get to the man or woman beneath the facade with which he meets the world at large, one finds almost without exception an underlying surprise that fate has dealt this blow, together with a considerable amount of guilt for sins, real and imagined, that may have caused the descent of disease, and a profound fearfulness that the illness may indeed be prelude to death.

As the patient begins to take in the fact that he really is ill, that he does need care and medical treatment, and that he can or must give

1 The intensity and unpredictable range of personal response to the diagnosis of tuberculosis have been well described in the literature (*1–4*).

up his responsibilities temporarily, he can begin to work on specific pieces of the problem—detailed arrangements about further appointments with the doctor, decisions about whom to tell of his illness, discussions regarding job or home. Each detail that must be met and acted upon involves the patient in a process of breaking up the all-engrossing emotional response and coping with the new situation piece by piece. And gradually he comes to the time when he can call to his aid his intellectual powers and thereby gain further release from stark fear.

How much directness and clear-sighted planning the patient displays in coping with the problem of acceptance of his diagnosis, or how much evasion and readiness to use his diagnosis to obtain advantage over spouse or children or in-laws depends on how this particular person has met and dealt with difficulties, loss, and change in the past and how this illness fits his emotional need at the moment. If in the past he has met obstacles and frustration with some perspective and equanimity, he is likely to do so in respect to his tuberculosis. He can set aside immediate personal aims and projects at home and at work and safeguard himself and his family by realistic planning. On the other hand, a rigidly organized and less secure person, afraid of new problems and unable to assimilate drastic change into his personal scheme of things, is likely to overreact to the fact of tuberculosis. The person's customary ways of accepting or refusing to accept responsibility, brought into his encounter with tuberculosis, may be particularly significant in the extent to which he can bear to let his doctors plan for him medically, and can himself assume an active part in furthering his medical progress.

Initial Adjustment to the Sanatorium

Regardless of the degree to which he has accepted or rejected t
diagnosis and planned well, or poorly, or not at all, each patient com into the sanitorium is employed in the universal psychological proce of adjustment to change and new experience. A new setting for everyday living—the sanitorium—confronts him, unfamiliar and different.

The experience of moving into a new situation is readily at hand in the personal experience of most people—leaving home to go to college, taking a new job, undertaking a long voyage. Changes such as these are generally self-initiated and actively sought, and curiosity and eager anticipation may therefore accompany them. At the same time they often evoke some misgivings as to the wisdom of so far-reaching a step, some question as to how the new venture will turn out, some uncertainty as to how one will establish himself with new people, and definite regret for loved people and favorite things that will be left behind. Once the new experience has been embarked upon, is there not invariably an effort to take into it some

tangible reminders of the old situation, to tie past and present together as quickly as possible?

Actually, of course, the patient's situation is quite different from that of the person who has actively reached out for and decided upon a new experience. For the patient is faced with change that, far from being self-sought, seems rather to be entirely imposed from without, from some whim of fate. A person with tuberculosis has probably rarely sought illness or come into the sanitorium with a sense of happy anticipation, whatever his unconscious motivation may be, except, perhaps, in the case of those who are acutely ill and feel the need for skilled medical care, or who are deeply uncomfortable about their continuance at home as a source of infection.

If there is question and fear in any major change, then we can surely expect to find patients who are to enter a sanatorium questioning and resisting the new situation, preparing for the move with a heavy sense of the tear of separating from relationships and activities in which they have been vitally involved.

Before coming into the sanatorium the patient has already undergone a continuous process of adaptation to his tuberculosis, beginning with his awareness of illness or knowledge of his diagnosis. He has, as a rule, been much engaged in the business of putting his affairs in order, including such tangible acts as disposing of property or personal possessions, valuable not only for themselves but also as symbols of one's place in the community, and such intangible acts as separating from members of the family and associates and leaving unfinished work in job or school. Separation from the familiar and established aspects of one's life requires a capacity to face the extended nature of the illness and to give up that which cannot realistically be maintained. The patient's psychological movement involves a process of "letting go" which is in the same direction, fundamentally, as that in which he is turned by reason of the very diagnosis: a "giving up" which often seems to him like the giving up of life itself.

Coping with fear that is so fundamental and threatening—even though in the particular case it may be essentially groundless—and deeply concerned with himself, exhausted emotionally and often physically from preparing for the move into the sanatorium, the patient comes into the sanatorium struggling to keep from others and even, at times, from himself the basic underlying death-fear which pervades all his attitudes and conduct.

Colored by this fear, innocent or even attractive aspects of this new situation become threatening and forbidding. "How tranquil and beautiful the sanatorium looks in the morning sun," said a doctor on the staff who had first known the sanatorium as a patient, "How barren and prison-like it looked to me as I first came in as a patient."

Once in the sanatorium the patient soon hears of long periods of

hospitalization experienced by other patients and unsuccessful efforts to control the course of the illness in individual cases. Sounds of coughing and sighing, and the restlessness of the first nights in the unfamiliar setting, reactivate his misgivings about himself and the step he has taken.

The patient will certainly ask himself, once he has had time to think about what has happened to him in recent days or weeks—and the sanatorium regime will give him much time to think—whether he and his family have made the wisest decisions in the circumstances. He may, despite all the statements of doctors and nurses who interested themselves in his hospitalization, still question whether he should have left job and home, knowing what his leaving means to his family. Unfinished business on the outside may still concern him, so that he cannot rest in any true sense until communication with employer or insurance company or public assistance agency assures an income for the family. And as long as he remains insecure about the plan temporarily agreed upon for the care of the children he is likely to remain uneasy. Whether the patient sees the sanatorium as a prison closing in on him or as a haven from storm, each person will have time to take stock and evaluate what he has been through and think about whether he has acted well in coming into the sanatorium at all.

The more mature person often quite consciously and with little help from others puts himself into the program of medical care in the sanatorium with all the force of his determination to get well and to protect others from his infection. "This is where I must live now," one such patient said, "and I have decided that I must leave to my wife decisions as to how she will manage until I am well. It puts a lot on her shoulders, but this business of getting well is my job now. If I com out, I can pick up on the other things." How often the phrase recu *If I come out,* not *when.*

To give up "the other things," to know that for the present the are less important than the recovery of health, a man or woman must be able to sift and weigh values and goals and "to hold his ground before reality." The patient who is secure in his basic independence is able to accept a temporary dependent role in relation to his wife and to the nurses and the doctors in the sanatorium. If the patient can also detach himself somewhat from the anxieties and intrigues and tragedies of his associates in the sanatorium, he can find in this life a measure of peace which, as far as we know now, offers the setting in which the curative process goes forward most effectively.

Not all persons have the strength and integration that enables them to say, "This is where I must live now," without bitterness or reservation and with an honest desire and capacity to bring themselves, all of themselves, into the sanatorium for the purpose at hand.

By contrast with the patient who accepts the sanatorium as the place where he must live for the present, there is the person with little flexibility or with little inclination to give up immediate pleasures and satisfactions for a more assured future. He finds the slow, tedious process of treatment in a sanatorium galling and tends to resist submitting to it. Basically dependent, he is often fearful of overt expression of his need to lean on others. He therefore resists and fights medical authority, the regulations of the sanatorium, and the submission to a necessary dependent status. With his underlying fear about the ultimate outcome of his illness and, therefore, a sense that his conduct of his affairs matters little, the patient may evade medical instructions about bedrest, sexual relationships, drinking, or the use of the hated bedpan. He thereby gains a childlike pleasure in defying the authority of the sanatorium at his own expense. Not infrequently this pattern of behavoir which we sometimes mistakenly interpret as "irresponsible" or even "stupid" is in reality based on the patient's conscious or unconscious need to prolong illness. Indeed, his basic dissatisfactions may be so great as to give rise to behavior which may be a manifestation of suicidal intent (*2*).

Role of Social Service

It is in this emotional environment that medical social work in the sanatorium offers its services. Are there ways in which each patient can be helped in terms of his own needs and individuality to make a successful adjustment to the setting and the medical program of the sanatorium? Can his transition from living at home to living in a sanatorium be facilitated, so that he becomes better able to accept the reality of his diagnosis and of his new situation? Can he be helped to put himself fully into the sanatorium, to accept the uncertainties of prognosis and the realities of inactivity and separation, and to cease from straining toward the outside?

Ideally, the medical social worker should be available for such help to all newly admitted patients. The new patient should be able to tell to the medical social worker what problems on the outside were left unresolved and decide with her on practical ways of meeting them, or, face the fact that they must be left unresolved. If he can tell what was hardest to give up, whether child or job or school, and if he can be himself with someone in the sanatorium who accepts him quite as he is, who is prepared to help him come to his own realization that he can tie up some pieces of life on the outside with his life in the sanatorium, he is more likely to find that he can bear to live in this situation. And last, because it is most difficult and most important of all, if the patient can be helped to bring his fear of death to consciousness, if he can face it fully and share it with another,

he is likely to discover that its heavy oppressive weight has been somewhat lightened and that it has been robbed of its terror in parts.[2]

Psychiatry

Although this paper is concerned primarily with the ways in which social service meets the problems of hospitalized tuberculosis patients it goes without saying that some of the personal problems presented by patients require the services of a psychiatrist. In this sanatorium, as in most of those in the Nation, there is no staff psychiatrist to consult with other staff members—doctors, nurses, social workers—and help them in their dealings and relationships with patients. When available, psychiatric services to patients are usually limited to diagnosing and planning for the severely emotionally disturbed or the frankly psychotic patient. It is a rare tuberculosis sanatorium that is able to offer psychiatric treatment to those other patients who are not psychotic nor even greatly disturbed but who seek and can respond to psychiatric help. As such service becomes more available, those patients whose emotional and psychological needs and problems are beyond the reach of the skills of other hospital personnel will be helped to achieve a sufficient resolution of fears and sufficient inner security to cope with their personal problems. And they will be able to cope more successfully with the problems more specifically related to tuberculosis.

One Patient's Experience in Adjustment

The story of Mrs. Douglas serves to highlight some of the necessary adjustments patients need to make. One morning in May 1948, a tray hurled across the room barely missed a nurse's aide. It had been thrown by a young woman in a temper because she had been kept waiting too long for her cup of coffee. What was back of this anger and moment of revolt and what action should the hospital take in such a situation?

Mrs. Douglas was a handsome 25-year-old woman, a French war-bride and the mother of three very young children. She had entered the sanatorium the week before and had been restless, dissatisfied and tearful all week, threatening almost daily to leave against advice. The culmination of the week's stresses occurred when she threw the tray. Such an incident of overt rebellion demoralizes a ward for several days and reverberates in the taut nerves of the more anxious, frustrated, and depressed patients. To let Mrs. Douglas stay in the sanatorium and risk further temper tantrums therefore seemed unfair to other patients, and unfair as well to the hospital attendants, whose uneasiness about exposure to tuberculosis tends to be accentuated by such outbursts especially if directed against them. But the wisdom of giving Mrs. Douglas a disciplinary discharge was also questionable, since such a course of action would jeopardize her chance

[2] A note about Dr. Wittkower who interviewed a large number of persons ill with tuberculosis is of interest in this connection: "For many years I have watched . . . Dr. Wittkower's interview technique . . . . At the end of an hour the patient knows a great deal more about himself than he ever knew before, not because of what Dr. Wittkower says to him, for he says remarkably little during the first hour, but because being free and feeling free to talk, the patient's narrative becomes a kind of self-discovery" (3).

at recovery, and because in her infectious state she would become an immediate danger to the health of her children and to others in the community.

After weighing these factors carefully the medical staff decided to give the patient another chance to adjust herself to the sanatorium on a different ward where the episode of the breakfast tray might be forgotten. The case was also referred to the medical social worker who, recognizing the fact that Mrs. Douglas would need regular and consistent help, made arrangements for a series of weekly interviews. These were scheduled, at the patient's request, during one of the visiting hours, when Mrs. Douglas felt most keenly her isolation from family and friends and the desertion of her husband, for he failed to visit or respond to her telephone calls. After a 3-month period of regular interviews, the patient was seen only on her special request, approximately once a month, until she left the sanatorium.

This patient's temperament and her social circumstances combined to make her continued stay in the sanatorium particularly difficult. She suffered the loneliness of a war-bride facing illness in a foreign country, remote from family and friends and those associations which can lessen the sense of unfamiliarity which hangs over a sanatorium. And, most important, she was neglected by a husband whom she needed psychologically and physically.

Mr. Douglas, who was alcoholic, had many periods of irresponsibility and unemployment. Mrs. Douglas was fiercely in love with him and was devoted to her children to the point of possessiveness, yet she was so much in conflict with her husband that she had left him twice, supporting herself and children by working as a waitress, maid, and cigarette girl in a nightclub. Two years earlier she had been hospitalized in another State but had walked out against medical advice after 6 weeks. She had refused hospitalization three times before her admission to our sanatorium. It was only after one of the children suffered from convulsions, a patch test was positive for the oldest child, and both Mrs. Douglas and the oldest child had gone through a severe attack of pneumonia, that the patient had agreed to sanatorium care. By this time her illness had progressed; the diagnosis of "minimal" 2 years earlier had become "moderately advanced" and she had a positive sputum.

While Mrs. Douglas had refused hospitalization again and again, it was not because she minimized her illness. On the contrary, she was profoundly fearful of tuberculosis, so fearful that she wrote to her grandmother saying that she was in a mental hospital.

The patient was found to need a great deal of help from the social service department. Frequent reports of the children were obtained from the child welfare agency and these were transmitted to her in detail. She needed to draw upon the small welfare fund available for toilet articles and for the repair of her radio. She hated these additional signs of dependency and her husband's part in subjecting her to it. Apprised of her financial and social situation, the occupational therapy department supplied materials without cost, and the patient busied herself with handiwork. That department also discovered, in giving Mrs. Douglas bedside instruction in shorthand, that she had fine intellectual capacity, an asset which the social worker could stress and help the patient use to fuller advantage.

There were frequent conferences between the doctors and the social worker as various crises arose in the life of the patient which threatened her ability to stay with the medical treatment. The medical social worker's interviews with Mrs. Douglas herself were scarcely tranquil. They usually started with the patient in a belligerent or depressed mood, expressed as much by the intentness with which she leaned forward with hands clenched against the arms of the wheel chair as by words and tears. Longing for her children and both love and hate for her husband preoccupied her constantly. Notes from the case record indicate the

nature of one such interview: "The patient said that it was quite likely that her husband was going to desert her. Even if he didn't, he wasn't too responsible. To go on without him would mean that she would have to find some way of supporting herself and the children. In view of her physical condition she would probably not be able to work and support all of them by her own effort. She would therefore have to place them. She felt that life apart from the children would have no meaning for her and that she and they might as well be dead. I accepted her feelings as she presented them. She went on to say there was nothing at all, nothing ahead for her, adding however, that the oldest child, Terry, needs her. As she talked about him and the other children, she moved from her sense of complete bleakness and ended with the conclusion that she was 'too young to die!' Much as she hated it here, she did not want to do the kind of thing that would jeopardize her chance of ridding herself of her tuberculosis."

Again and again the same process is followed: the patient is given opportunity to present all the negatives in the picture as she sees them, to evaluate the alternatives before her, and to come to her own decision to remain or not to remain in the sanatorium.

The report of another interview states: "Mrs. Douglas was reminded that she had met her problems to date by striking out at her opponents, fighting hard and persistently for what she wanted. In this situation, coping with tuberculosis, she would find that the aggressiveness which she put into meeting her problems formerly would have to take a new form, since relaxation and patient waiting represent the type of weapon that has a place in coping with this problem. She recognized that this kind of demand was hard for her."

Each interview indicated that she was working on understanding herself more fully, however. For example, she reported an episode on the ward involving another patient which led her to say that it was a new experience for her to think about another person's feelings; and that she was not sure that she wanted to change that much—she wanted to hold on to the more self-centered "me" that was familiar to herself, she thought. It was suggested that possibly no one could respond successfully in a sanatorium without changing somewhat, and that that was perhaps especially true for Mrs. Douglas whose whole personality was geared to action. She became quite thoughtful, concluding with: "Being in the sanatorium is like being in the army—it either makes you or breaks you." She decided, too, that she would like her husband to have some form of psychological help, saying that she had been confused and at odds with herself and the world until she had accepted help from the social worker, and that now she felt clea as to her direction and goals.

With the help she had had in her struggle to make peace with living in the sanatorium, Mrs. Douglas was able to remain 7 months. She had had successful minor surgery, her sputum had been converted, and she felt that the period of convalescence ahead, including regular pneumothorax treatment, was one that she could best bear if she could work something out with her husband and see the children from time to time, now that she was not an immediate source of infection to them.

The patient did leave the sanatorium at the end of this period, without full medical consent. She managed to communicate messages to the social worker at long intervals, and a letter from her when she was finally discharged from the clinic is of interest if one attempts to evaluate the expenditure of medical and other service on behalf of this patient. The letter which came a year and a half after the episode of the tray stated: "The doctors at the clinic told me last week that I am classified as an arrested case. I am very happy about it. We bought a little home through the GI Bill and that adds to my almost complete happiness, and we have brought Terry and Ann home. Everything turned out so wonderful,

it's almost unbelievable. We don't have much furniture, but we will get a piece at a time. . . . After all I have been through I have developed a lot of patience and I can surely wait until we can afford things. . . ."

The problem throughout the period of case-work service with Mrs. Douglas was to find ways in which this patient's very eagerness for living could be mobilized and utilized in her treatment. With all of her fears about tuberculosis and its effect on her family situation, her acute longing for her husband and children, and the financial problems with which she struggled throughout her sanatorium experience, it was necessary to find a way to help her remain in treatment. Her positive desire for living, manifest in her very eagerness to be with her husband as wife and homemaker and in her delight in her children, had to be so utilized that it would not destroy her but would, rather, result in development of capacity to hold to a goal—recovery from tuberculosis. Leaving the sanatorium when she was no longer infectious, continuing her treatment at home under medical advice from the chest clinic, working out a more stable relationship to her husband and children, she developed a capacity for responsible action that was a far cry from the childlike rebelliousness symbolized by throwing a breakfast tray at an attendant. Mrs. Douglas had to achieve real change within herself and she did so, though she approached failure more than once.

Surgery

Facing a decision as to whether to undergo surgery focuses at one point the most negative aspects of treatment. Surgery, probably more than any other medical procedure or requirement, involves the patient most deeply in the helplessness which sickness always prescribes in some part. To put one's life into the hands of another, the surgeon, requires a yielding of the self in full faith and trustfulness, together with a sustaining determination to get well even at the cost of considerable pain and possible deformity.

Listening carefully to what the patient himself says, a simple enough procedure, is still a neglected factor at times in the management of a patient's tuberculosis. Days and weeks of indecision can at times be saved for a patient who is resistant to surgery if he has help in stating his doubts and fearfulness, in letting him sift out for himself what is reasonable from what in his feeling is sheer fantasy.

Patients do not always themselves see the relationship of social and medical developments and sometimes wait too long before they turn to anyone in the sanatorium for help. A young man of 30, whose tuberculosis had seemed almost under control, suddenly reversed his uneventful course towards recovery, suffered a spread of his disease, and eventually underwent surgery. This was followed by complications that were almost fatal, further spread of the disease to other

parts of the body, and a steady downhill course medically. Talking to the social worker about his personal problems, he said, in reference to the timing of the turn of events, "It was the week I went up for the operation that my wife wrote me her plan for divorce. I spent most of the day before the operation reading every letter she has written me here, to see when this change in her feeling towards me really started." Was it entirely coincidence that the patient had developed serious complications following that kind of emotional strain the day before his operation? Had doctor, nurse, or social worker been close enough to this patient to know what he was going through, would not delay of the operation until his despair was less acute have possibly changed the outcome of surgery and perhaps averted further physical deterioration?

Watching patients in their conflict between accepting and rejecting surgery, one could not but conclude that in some cases a patient does not want to risk recovery and discharge from the hospital. Many complex and often contradictory forces play upon him. Even the will to get well may be modified by an opposing desire to not get well. The patient who loses his desire to get well, or perhaps never firmly had it, presents possibly the most subtle and elusive demand upon the skill of the sanatorium staff.

Marital Difficulty

Important personal relationships that have failed him are most often causative factors in the patient's negation of living and he often needs help with his feelings about these relationships before he can think clearly about medical treatment. At times the relationship to the medical social worker is found to have significant bearing on the effort to get well, as he works out with her his conflicts about his social situation or his doubts about his potentiality for health and arrive at a realization of his failure to use the sanatorium's facilities fully. This was true in the Tomlinson case. The patient's family crisis coincided with important medical development in his case and he could not accept medical recommendations until he had worked through his emotional disturbance and reevaluated his immediate aims.

Late one afternoon, Mr. Tomlinson, a gaunt man in his early thirties, was brought to the office of the medical social worker in a wheel chair. With the muscles of his face tense and unsmiling he said, "Are you any good at domestic problems?" Without waiting for reply he told of growing strain in his relationship to his wife which had culminated in a scene the preceding Sunday. She had announced that this was the last time he would see her—they were entirely through as far as she was concerned. Three days later, after the medical conference, he had been advised that now, 18 months after his admission to the sanatorium, the doctors recommended thoracoplasty on the left side. He ended simply and emphatically, "I could only say to my doctor that I would not have

surgery. I couldn't possibly undergo surgery now—I would never pull through." His impulse was to leave the sanatorium in an effort to see what he could do to save his marriage, but he was not at all sure that he had the physical strength to go out into the city and engage himself in that undertaking. The doctor, after talking over the problem with him, had suggested that he see the social worker.

Following this interview the social worker and the doctor reviewed the situation together. The diagnosis was "pulmonary tuberculosis, far advanced, bilateral." Some months before, consideration had been given to an early transfer to the convalescent hospital, but a subsequent positive sputum and a spread of the disease resulted in a medical condition which finally led to the recommendation for thoracoplasty. The doctor felt that in spite of the urgency of this man's marital problem this patient could not be given permission to leave the sanatorium to try to settle his personal affairs. The doctor stressed the importance of time. The moment for surgery would pass quickly and there would be further spread of the disease if the patient did not undergo the operation soon.

During the next several weeks the medical social worker spent a good deal of time with this patient and had numerous telephone conversations with his wife, with friends of the family, with the minister who visited him at the sanatorium, and with legal aid and child welfare agencies. The facts were all too familiar in the sanatorium. Mrs. Tomlinson, at loose ends during her husband's long illness, had apparently had a series of affairs with other men and had left the city with one of them.

In interviews with the patient, the social worker brought him information which he requested regarding the whereabouts of his children and his legal rights regarding their custody. He was also concerned about his property. At the same time the social worker kept before him the alternatives that he himself saw in the situation: to put his energies into trying to locate and either win back or punish his wife; or to go through with the medical recommendation for surgery. Neither choice was palatable to the patient, and he continued to be afraid of surgery because of his state of confusion and anger. Gradually, in going over and over the situation with the social worker, the patient emerged from his bewilderment and hurt and arrived at the point where it became clear to him that he had not understood what his wife was really like and that he would do best to face that fact, put her out of mind, and turn his energy into getting well. The external situation itself remained unchanged, for the social worker could not bring back an unwilling wife. But, Mr. Tomlinson, with patience and understanding on the part of the social worker who could appreciate the strength of his conflict, was finally able to decide that whatever happened in the relationship to his wife, his life was important to him in and of itself. When he reached this clarity of thought and action, the doctor felt that the operation could be performed.

The patient agreed to surgery and went through with it, not without complications, however. There were some weeks following surgery when it was not at all clear to the medical staff that the patient would survive.

Several months after the last operation, Mr. Tomlinson passed through a period in which he felt depressed, as he realized that he had to face going out of the sanatorium with no home to which to go. He had been so near to relinquishing living, both physically and pyschologically, that it was almost with conscious effort that he took up personal problems and regained any desire for a life of his own on the outside. The social worker during this period let him state his sense of being different from what he was before. He said he had no "ambition" and that he was frankly unsure of himself; his old sense of personal adequacy and capacity to undertake new things, whether in jobs or sports or friendships, was gone. This new awareness of physical limitation was certainly realistic in view of

the patient's medical history. It seemed to the social worker, however, that the patient's emotional crisis over his wife's desertion and his proximity to death had left their mark on his personality so that he felt himself more limited both physically and in his capabilities than need be.

In an effort to engage his interest the social worker and rehabilitation counsellor attempted to discuss with him some plans for the future. However, he was unable, while in the sanatorium, to grasp hold of this. The sense of withdrawal from living remained, and the social worker could only hope that, as he faced actual problems, he would gradually be drawn back into a more vital relationship to things on the outside. Reports received about the patient from the convalescent center to which he was transferred indicated that this was possibly happening even before he returned to the outside community.

For purposes of this paper, it may be worth noting that the doctor believed that considerable time had been saved for the patient, and the help he had received from the social worker had made possible his chance to have surgery at all during this crisis in his life.

Dependency on the Sanatorium

The pattern of living in the sanatorium fosters egocentric attitudes, and some patients are in any case content to be relieved of responsibilities that they have found onerous or distasteful or uninteresting. The sanatorium necessarily places much emphasis on protecting the patient both from physical exertion and from emotional stress. Reduced to an infant-like dependency in physical matters, the patient at times finds it difficult to maintain his perspective as to areas of conduct in which he can still act responsibly, with full use of his mature powers of judgment and mentality. The medical social worker received frequent complaints from patients of the failure of relatives or foster parents or children to visit or write to them. Many of these complaints involved indifference or thoughtlessness on the part of those outside but, on examination, some complaints were found to be unjustified, and the patient had to be asked in detail about the exte to which he had himself tried to keep in touch with the relative, fos mother, or child by letters.

Sometimes, the sanatorium comes to fill the patient's life so fully that he has no need for the outside world, and this occurs not alone in cases of chronic long-persistent infectiousness but also in some situations in which the patient can, from a medical standpoint, look to discharge within a reasonable and fairly predictable period of time. In addition to maintenance and recreation, the sanatorium sometimes provides a part-time job at light work which yields the patient a small income. Or, with time on his hands and perhaps a weakening or severance of family ties, he forms new interests in books, and hobbies and recreation, and new relationships which may fill his need for companionship and, in some cases, for sexual gratification. And at the same time there are few or no demands on him for assumption of responsibility. Looking back over the life histories of some of the patients who tend to cling to life in the sanatorium in this way, one

can often understand clearly why they need to make of tuberculosis their whole way of life, limited and circumscribed though it is. Many of these patients have had lives so warped and unfulfilled that, like the woman who was quoted at the beginning of this section, they "come to love this place" for they had indeed known no peace until they found their way into the sanatorium.

Life in the sanatorium is seductive, and the maintenance of a balance between giving up responsibilities and carrying some of them is all important if the illness is not to destroy the individual as a person and impair or undermine his relationships as well. It is this writer's impression, further, that withdrawal from responsibility and outside relationships, which is partially forced upon the patient by medical needs, may in itself be a deterrent to his effort to get well. To the extent that the patient holds to established family relationships and associations that are meaningful in the outside world, he is motivated to greater effort in getting the business of treatment over and done with so that he can take up adult responsibility on the outside.

Alcoholism

Every sanatorium and every public health official dealing with tuberculosis has a more or less unresolved problem of management of tuberculosis in patients who are alcoholics and, incidentally, in the case of the husband or wife of an alcoholic. Admittedly large sums of money and effort in tuberculosis control are wasted because of failure to treat alcoholism itself. The medical social worker in the sanatorium can play a part in dealing with alcoholic patients and, here and there, may help a patient use his sanatorium experience to get his alcoholism as well as his tuberculosis under control. The problem, however, is not usually amenable to treatment by the social worker alone. The full array of knowledge and resources of medicine and, specifically, psychiatry, must be directed to this problem if alcoholism, like any other complicating disease, is not to undermine medical efforts to manage tuberculosis.

Leaving

Most patients are surprised to experience an element of strange reluctance to take the step of leaving the sanatorium. Patients who have waited tensely and with almost unbearable eagerness to leave may find themselves taken aback when the actual word of medical discharge comes, and almost without exception they feel guilty that they could not meet the news with unmixed feelings.

With some support by the medical social worker, patients can express their questions about what is ahead: "Will I be wanted at home, or will they be a little afraid to have me around the children?" "I

don't know whether I can get my old job back or one like it." "I wonder if I will be much use on the outside, having to be so careful of not overdoing." "I don't know whether I can study any more; this life changes your work habits." "I don't know how I can get along financially." "I hate it here but at least I am accepted as I am." "I am afraid of . . . a hundred different things . . . another breakdown, no job waiting for me, loss of chance at new job, being ostracized by friends, not having the old place in the family, or, even more serious, no husband to go to, everything changed and different in the household, no family, no home to go to." Almost all patients attest to some uncertainty as to their capacity to function adequately, or as adequately as before, when they anticipate going out into the community. Whether they will be able to maintain their gains in health, knowing how many patients with tuberculosis break down again, is a recurrent question.

The sanatorium, with all its restrictive features, has become familiar and acceptable. Friendships among patients, like those among men at war, take on special meaning because they are forged during crises lived through together and they continue over many months and years. It is with a sense of real loss that patients leave these friends, some of whom, they have reason to believe, will never recover.

If, as often happens, the patient has exhausted all his savings and cannot return to his old job, he is much worried about money. Not only is he concerned about long range problems of a home and a job but he is immediately confronted with the fact that he has gained 40 pounds and does not have a pair of pants to wear home. The more drastic the changes that have developed in the family, the more reluctant is the patient to return to the community outside, and the more grateful for a convalescent center to which he can go during the transition from the sanatorium to life in the outside community.

Many patients are fearful of being removed from doctors and nurses. All physicians have had experience with the patient who, on two or three occasions, springs a positive sputum, after all signs indicate that he will be considered medically ready for discharge within a few weeks. All also have experience periodically with the patient who, though medically ready for discharge, delays the date of departure, develops symptoms for which no organic basis can be found or which involve illnesses that can be treated outside the sanatorium equally well or better. It is these patients who, again and again, are found to have some major dislocation in their homes, or who are to return to a home which they left with considerable sense of escape.

The period following hospitalization is critical for many. Patients often require as much help in adjusting to living outside the sanatorium as they did to living within it. After leaving the protection of the hospital they find themselves again in an environment where good

health, rather than illness, forms the basis for the way of life around them.

A patient who had had five admissions to the sanatorium in 9 years reminded the social worker of all he had disclosed to her—his sense of having been cast adrift after his mother's death, his long-accumulated hatred of his alcoholic father, his despair at the break-up of his own marriage, which in turn left him with his father's home as the place to which he felt he had to return after each discharge—and he said, "These are the things you can't tell most people. But they explain why I hate to go out of the sanatorium though I dislike it here, goodness knows, and why I come back again and again."

At the point when the patient is being considered for discharge, his greater freedom of activity within the sanatorium and his need for vocational planning may make it possible for him to get from other departments, such as rehabilitation counseling, library, and occupational therapy, some of the emotional reassurance he needs for his movement out of the sanatorium. The matter of making the move out of the sanatorium should not, however, be left to the patient to handle as best he can, with such support as he happens to be able to draw upon from his various connections in the sanatorium. Under conditions of adequate staffing, the social service department has an opportunity to plan with all patients well in advance of the actual discharge. When there is an inadequate number of social workers, every effort should be made to have at least one interview with all patients who are planning to leave and the interview should take place at least 2 months before the patient goes home. This interview is important for those who have special problems awaiting them on the outside. It gives the patient a chance to review the aspects of living which he will face when he again takes his place among those outside sanatorium walls. It is important for the responsible persons in sanatorium to understand the patient's feelings about leaving and assuming responsibilities, and to have some understanding of his knowledge of the extent of his physical capabilities and the degree to which he may overreach, or overprotect himself.

The psychological support which the social worker offers at this time is of considerable significance in the individual's movement from illness to convalescence and health. He is confused by his contradictory feelings of eagerness, regret, and uncertainty about the future. He has a sense of having had an experience, for good or ill, that sets him apart from the world into which he is going. He needs opportunity to look at his inner world and sort out his feelings and his dreams, to see what is fact and what fiction, and to evaluate the reality that is his individual circumstance at this time. No words of reassurance can take the place of the self-understanding and self-evaluation achieved when a person expresses to another his real

feeling and not his sense of how he ought to feel. The questions which are put to him bring out his doubts and help him clarify his thinking and feelings about the situation he is leaving and the one he is going toward. Because he is helped through his problems he is sufficiently freed of indecision, of conflict and regrets so that he can take the necessary steps to get himself back into his home, and work, and community life.

For the patient to leave the sanatorium entirely reluctant is of serious consequence to the individual and a threat to the community. If the outside world appears to him to be too indifferent or even hostile he may respond by driving himself too hard and before long, he will be back in the protected environment of the sanatorium. It is therefore of the utmost importance that he have full opportunity to prepare himself—emotionally, intellectually, and physically—for leaving. And the sanatorium officials need to be as certain as possible that he is well prepared before they let him go.

Many patients who have really been able to come to grips with the hard and painful experience of hospitalization leave the sanatorium with greater inner strength, greater insight, and greater sensitivity to themselves and others. "This whole experience in the sanatorium has been ghastly," a sensitive and gifted young woman said as she came to bid good-bye to the social worker, and then she added thoughfully, "but I've got hold of something here. I came in a carefree person, and the world was mine for the asking. I used to go dancing and have dates and dinner parties all at once, and many of them. I've learned the hard way that I can't have everything." And then she went on to say almost poetically—"But how exquisite every ordinary experience can be just because you're alive to it, and what a treasure of delight there is in anything extraordinary, just because you can have only a limited bit of it at a time."

REFERENCES

(*1*) Coleman, Jules V., Hurst, Allan, and Hornbein, Ruth: Psychiatric contributions to care of tuberculous patients. J. A. M. A. **135**:699–703 (1947).
(*2*) Hartz, Jerome: Human relationships in tuberculosis. Pub. Health Rep. **65**:1292–1305 (1950).
(*3*) Wittkower, Eric: A Psychiatrist Looks at Tuberculosis. London, National Association for the Prevention of Tuberculosis, 1949, p. 10.
(*4*) Bloom, Sophia: Some economic and emotional problems of the tuberculous patient and his family. Pub. Health Rep. **63**:448–455 (1948).

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended July 14, 1951

Poliomyelitis

A total of 616 cases of poliomyelitis was reported for the current week, which is 50 percent greater than the 409 cases reported last week. For the same week last year a total of 662 cases was reported. The cumulative total for the calendar year is now 3,861 as compared with 4,318 for the same period last year. Since the seasonal low week late in March, 2,648 cases have been reported, which is 17 percent below the 3,187 cases for last year. The only States which have shown a significant increase, 50 percent or more, in the cumulative total since the seasonal low week for this year as compared with 1950 are (1950 total is shown first): Massachusetts (14–32), Wisconsin (39–63), North Dakota (1–15), South Dakota (8–26), Georgia (29–93), Florida (72–113), Alabama (65–117), Louisiana (66–146), Colorado (25–71), Arizona (33–55), and Washington (20–33).

The geographical regions which showed substantial rises in the number of cases for the current week as compared with the previous week were the East North Central, West North Central, and South Atlantic. In the East North Central States, the increase took place only in Ohio and Illinois. In the West North Central group, Iowa and Missouri accounted for most of the increase, and in the South Atlantic area Georgia and Florida showed significant increases. Although there was a moderate rise in the number of cases in the East South Central States, only Tennessee showed a significant increase. In the West South Central States, Arkansas, Louisiana, and Oklahoma reported essentially the same number of cases for the current week as for the previous week. Texas reported 92 cases as compared with 58 for the week ended July 7. The Mountain and Pacific States reported the same numbers as last week except for California, where the number rose from 39 last week to 58 for the current week.

Weekly summary reports from the various States showing county distribution of cases, which are available up to and including the week ended July 7, have not revealed any large concentration of poliomyelitis

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cases in localized areas except for those previously mentioned, namely, in northwestern Louisiana and in the Corpus Christi area of Texas. Reports would seem to indicate that there is a leveling off in the number of cases in both areas. When reports showing county distribution are available for the current week it may be possible to determine more definitely other areas or contiguous groups of counties with relatively high incidence of the disease.

Smallpox

One case of smallpox was reported in Kentucky for the current week.

Epidemiological Reports

Malaria

According to a summary prepared by Dr. A. L. Gray, Mississippi State Board of Health, seven proved and two probable cases of malaria were reported in Mississippi during the first 6 months of 1951. All of the cases have been reported since May 24, and have occurred only in military personnel who had served in Korea. The ages of the group varied from 19 to 27 years. Six *Plasmodium vivax* infections and one *Plasmodium malariae* were confirmed by laboratory examination. Two cases in which laboratory confirmation was not obtained had received treatment a short time before blood smears were taken. Six of the cases had suppressive treatment while in military service in Korea, and one had a history suggestive of malaria prior to military service. Dr. Gray states that this number of known cases of malaria

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	July 14, 1951	July 15, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)		1		(1)	(1)	(1)	(1)	40	26	29
Diphtheria (055)	40	60	89	27th	40	60	89	2,048	3,188	4,699
Encephalitis, acute infectious (082)	26	17	14	(1)	(1)	(1)	(1)	[2] 489	398	260
Influenza (480–483)	187	232	232	30th	130,147	148,951	148,951	115,605	138,367	128,110
Measles (085)	7,579	5,164	5,164	35th	479,741	295,664	569,415	451,040	276,534	533,201
Meningitis, meningococcal (057.0)	73	55	58	37th	3,533	3,314	3,195	2,572	2,400	2,223
Pneumonia (490–493)	574	888	(3)	(1)	(1)	(1)	(1)	43,616	57,110	(3)
Poliomyelitis, acute (080)	616	662	662	11th	[4] 2,648	3,187	3,187	[4] 3,861	4,318	3,601
Rocky Mountain spotted fever (104)	15	23	26	(1)	(1)	(1)	(1)	159	215	220
Scarlet fever (050) [5]	525	333	487	32d	67,668	55,502	79,279	51,977	39,063	56,735
Smallpox (084)	1			35th	16	43	67	8	23	46
Tularemia (059)	11	16	28	(1)	(1)	(1)	(1)	369	546	568
Typhoid and paratyphoid fever (040, 041) [6]	80	88	100	11th	809	1,086	1,119	1,244	1,596	1,604
Whooping cough (056)	1,170	2,363	2,176	39th	63,201	95,638	83,683	41,599	74,102	53,039

[1] Not computed. [2] Deduction: North Carolina, week ended June 23, 1 case. [3] Data not available. [4] Additions: Indiana, week ended June 30, 4 cases; Virginia, week ended July 7, 2 cases. [5] Including cases reported as streptococcal sore throat. [6] Including cases reported as salmonellosis.

returning to Mississippi is disturbing and indicates the possibility of local outbreaks being caused by them in the communities to which they return.

Shigellosis

Dr. D. S. Fleming, Minnesota Department of Health, has reported an outbreak of shigellosis in an institution for the feeble minded, which has a population of 2,900 persons. In 11 of the 71 clinical cases *Shigella sonnei* was identified in stool specimens. The investigation of the outbreak is still in progress.

Gastroenteritis

Dr. Morris Greenberg, New York City Department of Health, has reported an outbreak of food poisoning in which 58 persons became ill out of a total of 115 who were exposed to risk. All were employees in a general hospital. None were found in hospital patients, nurses, or physicians, whose food is prepared in other kitchens than the one serving the employees dining room. Preliminary investigation revealed that the probable cause of the outbreak was boiled ham which was not refrigerated after cooking. This food remained exposed in the kitchen for about 12 hours before serving.

Dr. W. L. Halverson, Director, California Department of Health has reported an outbreak of gastroenteritis at a recreational camp in Fresno County which occurred between July 8 and 14, inclusive. There were approximately 40 persons who had symptoms of vomiting and diarrhea. The county health department is conducting an investigation. The etiology has not yet been determined.

Reported Cases of Selected Communicable Diseases: United States, Week Ended July 14, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**40**	**26**	**187**	**7,579**	**73**	**574**	**616**
New England	**2**	**1**	---	**570**	**2**	**13**	**20**
Maine	---	---	---	45	---	2	1
New Hampshire	---	---	---	---	1	2	---
Vermont	---	---	---	44	---	---	---
Massachusetts	1	1	---	378	---	---	17
Rhode Island	---	---	---	20	---	1	---
Connecticut	1	---	---	83	1	8	2
Middle Atlantic	**6**	**4**	**1**	**1,809**	**15**	**94**	**44**
New York	4	3	(1)	1,008	10	49	26
New Jersey	1	1	1	457	2	14	7
Pennsylvania	1	---	---	344	3	31	11
East North Central	**7**	**13**	**1**	**2,489**	**16**	**61**	**111**
Ohio	4	---	---	1,331	6	---	24
Indiana	3	---	---	50	---	13	8
Illinois	---	8	1	321	3	38	40
Michigan	---	5	---	118	4	10	24
Wisconsin	---	---	---	669	3	---	15
West North Central	**2**	**1**	**5**	**239**	**2**	**41**	**53**
Minnesota	2	---	4	25	2	11	7
Iowa	---	---	---	75	---	1	12
Missouri	---	---	1	67	---	---	13
North Dakota	---	1	---	41	---	29	4
South Dakota	---	---	---	10	---	---	2
Nebraska	---	---	---	3	---	---	7
Kansas	---	---	---	18	---	---	8
South Atlantic	**11**	---	**56**	**639**	**9**	**57**	**73**
Delaware	---	---	---	20	---	---	---
Maryland	1	---	---	251	---	21	6
District of Columbia	---	---	---	12	1	6	---
Virginia	1	---	51	210	2	18	4
West Virginia	4	---	---	28	---	---	3
North Carolina	4	---	---	18	2	---	7
South Carolina	1	---	1	8	1	7	3
Georgia	---	---	4	46	---	5	32
Florida	---	---	---	46	3	---	18
East South Central	**2**	**3**	**4**	**88**	**8**	**73**	**60**
Kentucky	---	---	2	11	5	46	1
Tennessee	1	3	---	34	---	---	16
Alabama	---	---	---	32	2	7	27
Mississippi	1	---	2	11	1	20	1[illegible]
West South Central	**5**	---	**26**	**460**	**10**	**163**	**155**
Arkansas	1	---	6	14	---	18	12
Louisiana	---	---	---	18	---	3	29
Oklahoma	---	---	20	32	---	22	22
Texas	4	---	---	396	10	120	92
Mountain	**4**	**3**	**78**	**271**	---	**34**	**33**
Montana	1	---	12	68	---	1	1
Idaho	---	---	---	31	---	---	---
Wyoming	---	---	---	11	---	---	2
Colorado	1	---	1	16	---	9	20
New Mexico	1	---	---	36	---	6	3
Arizona	---	3	65	66	---	18	5
Utah	---	---	---	43	---	---	2
Nevada	1	---	---	---	---	---	---
Pacific	**1**	**1**	**16**	**1,014**	**11**	**38**	**67**
Washington	---	---	4	68	2	---	5
Oregon	---	---	10	209	1	9	4
California	1	1	2	737	8	29	58
Alaska	---	---	---	---	---	2	---
Hawaii	---	---	7	52	---	---	---

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended July 14, 1951—Continued

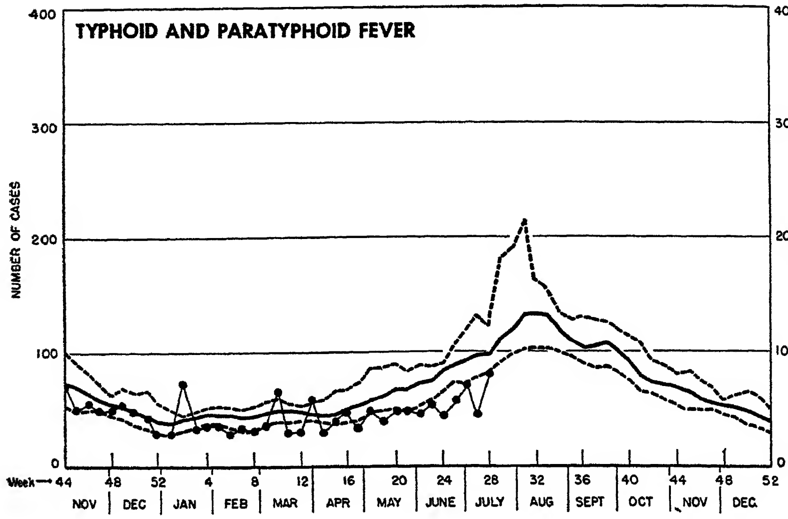
[Number under diseases are International List numbers, 1948 revision]

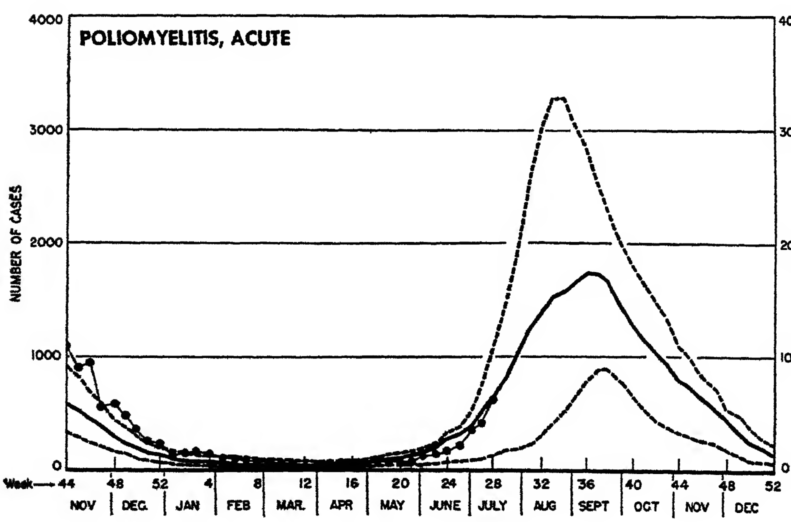
Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040,041)	Whooping cough (056)	Rabies in animals
United States	15	525	1	11	80	1,170	151
New England	-	48	-	-	2	47	-
Maine	-	-	-	-	-	9	-
New Hampshire	-	1	-	-	-	-	-
Vermont	-	-	-	-	-	3	-
Massachusetts	-	30	-	-	2	28	-
Rhode Island	-	11	-	-	-	1	-
Connecticut	-	6	-	-	-	6	-
Middle Atlantic	4	108	-	-	9	118	16
New York	3	59	-	-	-	51	11
New Jersey	1	20	-	-	1	38	-
Pennsylvania	-	29	-	-	8	29	5
East North Central	-	161	-	1	11	143	16
Ohio	-	72	-	-	1	24	3
Indiana	-	9	-	-	2	14	11
Illinois	-	13	-	1	4	27	-
Michigan	-	48	-	-	4	39	1
Wisconsin	-	19	-	-	-	39	1
West North Central	-	17	-	1	1	52	23
Minnesota	-	1	-	-	-	2	7
Iowa	-	-	-	-	-	18	6
Missouri	-	7	-	1	1	14	7
North Dakota	-	4	-	-	-	1	-
South Dakota	-	-	-	-	-	3	-
Nebraska	-	2	-	-	-	-	3
Kansas	-	3	-	-	-	14	-
South Atlantic	7	31	-	1	14	183	11
Delaware	-	-	-	-	-	-	-
Maryland	-	4	-	-	-	4	-
District of Columbia	-	1	-	-	-	3	-
Virginia	4	5	-	1	5	36	3
West Virginia	-	3	-	-	1	28	1
North Carolina	3	13	-	-	2	51	-
South Carolina	-	-	-	-	1	5	3
Georgia	-	1	-	-	5	30	4
Florida	-	4	-	-	-	26	-
East South Central	1	18	1	-	12	71	19
Kentucky	-	3	1	-	4	16	17
Tennessee	1	12	-	-	4	18	-
Alabama	-	2	-	-	3	13	2
Mississippi	-	1	-	-	1	24	-
West South Central	1	22	-	7	20	381	64
Arkansas	-	2	-	3	4	30	3
Louisiana	1	-	-	-	5	1	[3] 26
Oklahoma	-	6	-	1	3	25	1
Texas	-	14	-	3	8	325	34
Mountain	2	19	-	1	7	95	1
Montana	1	-	-	-	2	8	-
Idaho	1	5	-	-	-	14	-
Wyoming	-	-	-	-	-	1	-
Colorado	-	1	-	-	2	34	-
New Mexico	-	1	-	-	3	9	1
Arizona	-	2	-	-	-	20	-
Utah	-	10	-	1	-	9	-
Nevada	-	-	-	-	-	-	-
Pacific	-	101	-	-	4	80	1
Washington	-	5	-	-	-	14	-
Oregon	-	11	-	-	-	3	-
California	-	85	-	-	4	63	1
Alaska	-	2	-	-	-	-	-
Hawaii	-	-	-	-	-	1	-

[1] Including cases reported as streptococcal sore throat. [2] Including cases reported as salmonellosis.
[3] Report for May.

Communicable Disease Charts

All reporting States, November 1950 through July 14, 1951





The upper and lower broken lines represent the highest and lowest figures recorded for the corresponding weeks in the preceding 5 years. The solid line is a median figure for the preceding 5 years. All three lines have been smoothed by a 3-week moving average. The dots represent numbers of cases reported weekly, 1950–51.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended June 23, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	6	------	------	------	------	3	3	------	------	------	------
Chickenpox	1,236	4	------	24	------	104	731	56	33	123	161
Diphtheria	11	------	------	------	------	10	------	------	1	------	------
Dysentery, bacillary	5	------	------	------	------	------	------	------	------	------	5
German measles	396	1	------	23	------	8	202	------	12	71	79
Influenza	39	------	------	33	1	------	4	------	------	------	1
Measles	1,334	4	------	151	8	115	364	49	33	378	232
Meningitis, meningococcal	3	------	------	------	------	1	1	1	------	------	------
Mumps	633	7	------	38	------	77	264	17	93	48	89
Poliomyelitis	5	------	------	------	------	1	3	1	------	------	------
Scarlet fever	308	2	------	1	1	61	40	38	26	45	94
Tuberculosis (all forms)	219	5	------	9	23	100	29	32	11	10	------
Typhoid and paratyphoid fever	10	------	------	1	------	7	1	------	------	------	1
Venereal diseases:											
Gonorrhea	271	5	------	11	13	39	42	32	14	48	67
Syphilis	62	3	------	3	3	21	16	5	7	1	3
Primary	7	------	------	------	------	------	4	1	1	1	------
Secondary	4	------	------	------	1	2	------	------	1	------	------
Other	51	3	------	3	2	19	12	4	5	------	3
Other forms	1	------	------	------	------	------	------	------	------	------	1
Whooping cough	162	2	------	------	------	30	61	18	2	13	36

NORWAY

Reported Cases of Certain Diseases—April 1951

Disease	Cases	Disease	Cases
Diphtheria	11	Pneumonia (all forms)	2,738
Dysentery, unspecified	5	Poliomyelitis	14
Encephalitis, infectious	1	Rheumatic fever	92
Erysipelas	266	Scabies	811
Gastroenteritis	2,781	Scarlet fever	101
Hepatitis, infectious	59	Tuberculosis (all forms)	342
Impetigo contagiosa	1,400	Venereal diseases:	
Influenza	2,651	Gonorrhea	167
Malaria	1	Syphilis	46
Measles	2,622	Other forms	1
Meningitis, meningococcal	13	Weils disease	2
Mumps	117	Whooping cough	1,404
Paratyphoid fever	2		

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently. A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Cholera

Burma. The incidence of cholera in the port of Mergui dropped to two cases for the week ended June 23, 1951, However, there was an increase during the next 2 weeks when 18 and 21 cases were reported.

India. Cholera has been decreasing continuously in Calcutta since the first week in May when 337 cases were reported. For the week ended July 7, 1951, the incidence was about a third (112 cases) as high as for the peak week.

Smallpox

Algeria. During the period June 11–20, 1951, 26 cases of smallpox were reported. This is the largest number reported for any 10-day period this year.

India (French). Twelve cases of smallpox were reported for the week ended June 23, 1951, as compared with 29 for the previous week. Of these, 4 were reported in Karikal and 5 were in Mahe.

Sudan (Anglo-Egyptian). During the week ended June 30, 1951, 10 cases of smallpox were reported in Darfur Province. For the two previous weeks there were no cases reported.

Typhus Fever

Afghanistan. During the week ended June 2, 1951, 22 cases of typhus fever were reported. These cases were chiefly in the Kabul Province. For the week ended May 27, eight cases were reported.

Algeria. Six cases of typhus fever were reported for the period June 11–20, 1951. Two of these cases were in the seaport of Philippeville.

Spain. During the week ended June 2, 1951, eight cases of typhus fever were reported in Granada Province. Previous to this report only one case had been reported in Spain for the year.

San Francisco Announces Examinations

The San Francisco Civil Service Commission will give Nation-wide examinations to fill two civil service vacancies in the field of public health—one for Chief, Division of Venereal Disease Control, and the other for Clinical Director of Psychiatry.

Entrance salary for the positions is $650 a month for a 5-day week of 40 hours. Provision is made for yearly increases to a maximum of $750. San Francisco city and county employees have liberal retirement, vacation, and sick leave benefits.

The Commission plans to hold the examinations at convenient places throughout the United States for those who cannot appear in San Francisco.

Applicants for the position of director of psychiatry must file by August 10, 1951, and applicants for the venereal disease control position must file by September 17. All inquiries will be given personal attention.

For information and application forms, write to Guy Hayler, Civil Service Examiner, San Francisco Civil Service Commission, Room 154, City Hall, San Francisco 2, Calif.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work. Articles of special interest are issued as reprints or as supplements, in which forms they are made available for more economical and general distribution.

Requests for and communications regarding the PUBLIC HEALTH REPORTS, reprints, or supplements should be addressed to the Surgeon General, Public Health Service, Washington 25, D. C. Subscribers should remit direct to the Superintendent of Documents, Washington 25, D. C.

Librarians and others should preserve their copies for binding, as the Public Health Service is unable to supply the general demand for bound copies. Indexes ill be supplied upon request.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price $4.75 a year. $6.25 foreign

Public Health Reports

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Public Health Reports

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Study of the Cost of Medical Care

—A Note on Survey Methodology—

By Isidore Altman and Ruth Wadman*

The cost of hospitalized acute illness to patients, as compared with their incomes and benefits received from voluntary health insurance plans, concern not only those who incur the expense but also those who organize and administer medical care programs. Information on the subject is scarce, partly because of the difficulty of getting full and accurate economic data which people are sometimes unwilling to disclose. A recent study on illness costs summarizes certain basic information collected from patients and from financial records maintained by physicians and hospitals. The methods are presented below with the hope they may be of use to those who plan similar studies.

A study of the costs of hospitalized illness in the District of Columbia has recently been completed, and the principal findings have been published in the Journal of the American Medical Association (*1*). In the performance of the study, some survey techniques were devised; certain phases of the study which were approached with some misgivings met with unexpected success, while others did not turn out so well. Our experiences, we feel, are worth setting down in the hope that others making similar studies will find them of some help and guidance.

The study was made to obtain information on (1) the cost of hospitalized illness among nonindigent persons and its relation to family income; (2) the division of the cost among hospital, physician, and other services; and (3) the degree to which prepayment plans are helping their members meet the cost of illness that involves a stay in the hospital. The study was sponsored by the Medical Society of the District of Columbia with the cooperation of the Medico-Chirurgical Society and the 13 general and allied special hospitals in the District of Columbia which participated in the study. The field work and statistical analysis were conducted by the Division of Public Health Methods of the Public Health Service.

Data were obtained from three sources: Social and economic information about the patients was obtained from them by personal

* From the Division of Public Health Methods, Public Health Service.

contact or mailed questionnaire; hospital charges were tabulated from accounts in the hospital; and physician charges were obtained by mailed questionnaire. No patient was approached without the written permission of his physician, and no financial record in any hospital was furnished without the patient's written consent.

Preliminary Steps

Every study entails a considerable amount of spade work before the first questionnaire is mailed or the first interview obtained. In a study such as this, in addition to planning of questionnaires and tabulations, satisfactory relations have to be established with physicians and hospitals.

Here, since the study originated with the Medical Society, no particular problem of physician cooperation arose. Approval for the study was obtained at a business meeting of the Society. The study directors subsequently held two meetings with members of the Committee on Medical Care of the Society to seek advice on such questions as whether to use the fees charged by physicians or actual collections (fees were chosen, because collections might have prolonged the study interminably), and how information on these charges might most feasibly be obtained from the physicians.

Most of the hospital superintendents were visited to acquaint them with the study and obtain their cooperation. Final agreements were worked out through the Hospital Council of the National Capital Area. The Council, seeking to protect its member hospitals from possible unpleasant repercussions, stipulated that written permission of the physician was necessary to interview the patient and written permission of the patient was necessary to obtain hospital financial data.

The study was started with a letter from the Medical Society of the District of Columbia to the physicians in the area. This letter named the organizations sponsoring the study; explained the need to interview patients in order to obtain certain data essential to the study; urged the physicians to sign and return request-for-consent slips promptly when these began to arrive; and reminded them that all data given by patients, physicians, and hospitals would be entirely confidential and used for statistical purposes only. Simultaneously an announcement of the study was released to local newspapers.

Procedures

The patients in the study sample were drawn from the admissions over a 2-week period in each of the 13 participating hospitals. These periods extended through November and December 1949, except for one hospital covered in January 1950. During the 2 weeks a hospital

was being covered, a list of its nonindigent admissions for the previous day was picked up early each morning by messenger from the study office. Each physician whose name was on the list as having sent a patient into the hospital was then addressed by letter that same morning for consent to have his patient interviewed. He was asked also for blanket consent to interview any of his patients who were hospitalized in one of the 13 hospitals during the study period. This was a convenience to the physician and very definitely a major help to those making the survey.

An interview questionnaire had already been prepared (appendix A). As physician consents were received, the study office identified the individual questionnaires by entering the name of the hospital, the name of the patient, and other data from the hospital admission lists. With these questionnaires in hand, interviewers set forth to see the patients. During the 2-week period at each hospital, a messenger delivered new patients' questionnaires from the study office to the interviewer daily. Three or four hospitals were covered simultaneously until all 13 were completed, a balance being struck between large and small ones to keep the work load within control.

In November and December the admission lists picked up averaged 67 patients per day. Office staff prepared the request-consent letters and built up the necessary card files of physicians and patients. A messenger and one clerk had to be on the job week ends to keep up with the volume of letters to be issued.

A questionnaire was sent by mail to patients who had left the hospital before they could be reached by the interviewer. The form used was changed slightly from the interview questionnaire to make it simpler for the respondent himself to fill out.

About a month was allowed between the close of the interview period at a hospital and the return by statistical personnel to obtain data on the interviewed patients' hospital charges. This interval gave the hospital time to close its books on most of those patients. The hospitals, with two exceptions, preferred to assemble the financial records themselves upon receiving a list of the patients involved.

About 2 months after the interview period at a hospital, the attending physician was asked by letter to furnish the following information: the amount charged each patient; any payment to him on these fees from a medical or surgical plan; whether the patient was medical, surgical, or obstetrical; and the name of the referring physician, if any. The reply form which accompanied this letter to the 734 attending physicians in the study is shown in appendix B. Physicians named as having referred patients were then queried by mail as to their fees. There were 402 referring physicians, of whom 226 were also among the 734 attending physicians. Considerable and very effective use was made of the telephone to clear up belated replies.

For patients who were members of either of the two prepayment medical plans in the District of Columbia, data on the amount of benefits received were obtained directly from their organizations. The amount of benefits commercial policies paid was determined by telephoning or writing the patients who held them.

Comments on Methods

Probably anyone who has undertaken a new study looks back with satisfaction on the soundness of some of the methods and procedures used. About others, he wonders why pitfalls were not foreseen—why some things were done in one way when another way would have been so much better. Such was the story here.

Orientation of Interviewers

To do the interviewing, six women were selected from the staff of the Division of Public Health Methods on the basis of their experience and aptitude. Two had interviewed respondents in house-to-house surveys. A third had had interviewing experience as a medical social case worker and in medical care studies. Although the other three did not have similar types of experience, their work, one as a medical-records librarian and two as junior statisticians on health studies, provided elements useful for handling the questionnaire in this study. All six, it was believed, would have the tact required to work with busy hospital personnel and with patients.

A brief on the purpose and method of the study and a manual to guide the interviewers in the conduct of their work at the hospitals were prepared, as well as an explanation of the items on the questionnaire and instructions for filling them out. This material was carefully reviewed with the interviewers before they started at the hospitals. A meeting 3 or 4 days later would have served to pool experience and iron out the slight variations displayed by individual interviewers in their understanding of a few items on the questionnaire. But this step was not feasible because of the need to keep patient loss at a minimum by having no interruption in the work at a hospital. The situation was met by individual consultation with the interviewers after scrutiny of their first completed questionnaires.

The interviewers were familiar in a general way with the type of coverage offered by the two prepayment plans in the District of Columbia. But a discussion of the salient features of each plan and the explanatory leaflet each plan issues would have given them a more comprehensive background of information.

Introduction of Study to Hospital Personnel

To save the interviewer's time in explaining the study to the hospital personnel with whom contact would be necessary and to

obtain their cooperation most quickly, it was important that they be informed of the study by the hospital superintendent. The extent to which the several superintendents explained this study to their personnel differed widely, from no announcement at all to personal introduction of the interviewer to staff members. This method is suggested for similar studies: that the superintendent announce the study by bulletin board or other appropriate means a day or two before interviewing begins; that he provide the interviewer with a brief statement defining the study and her mission, making it clear that she has the permission of the attending physician to see the patient; and that he introduce her to necessary key persons in the hospital.

Introduction of Study to Patient

It was an unbreakable rule in this study that no patient was to be seen until the interviewer had learned, either from the charge nurse of the section or a special nurse to whom this nurse referred her, whether the patient was well enough to converse. The nurses were cooperative, and this procedure, even though it sometimes meant waiting a bit until the charge nurse was free, took less time than might be supposed.

In a hospital a patient is preeminently in a protected position. Those who come to his bedside do so to give a service or as personal visitors. The interviewer in this study came to him as a stranger and to ask a service—that he participate in a study of medical economics. In such circumstances the interviewer introduces herself to the patient and explains the study and the purpose of her visit. She needs to do this as simply and briefly as possible in order not to tire the patient and also in order to conserve time for a maximum number of interviews each day. Yet her approach to every patient must be leisurely, fresh, and unroutinized, alert to the patient's reactions and point of view.

Voluntary Participation by Patient

The patient is the one to decide whether he is willing to be interviewed. Abstracting from the interviewers' manual: "Participation in the study by the patient is entirely voluntary. The physician's consent letter is a permission to visit the patient in the interests of the study. It does not require the patient to be interviewed and is never to be interpreted as an order for that." Because it might be so construed, the interviewer was cautioned against showing it to the patient. Again from the manual: "If the patient himself should raise the question as to whether his physician approves the study, your answer obviously is that his physician is interested, cooperating, and aware that his patients are being visited. Only if it becomes

necessary to verify your statement to the patient would you use the consent letter, and that necessity is remote."

Full Cooperation by Patient

Once the patient had consented to participate, care still had to be taken to hold his cooperation throughout the interview. Amount of income was something which he might hesitate or perhaps even refuse to tell though responding to every other question. This was a crucial point since a questionnaire which lacked income data was lost to the study.

To spring a delicate question is unfair to the respondent and unproductive of his continuing cooperation. The interviewer, in her explanation of the study, had paved the way to the income question. The descriptive statement which had been prepared for her use and adaptation read: "The study will produce information on matters which are of concern to all who have had the expense of illness. Such matters, for example, as the cost of a sickness severe enough to require hospitalization and the relation of that cost to the family income; the loss of income sickness causes; the plans and means people have for meeting sickness bills."

At an appropriate point in the conversation, the interviewer made it clear that all information a patient gave on whatever topic was confidential and would be used for statistical purposes only. When the time came in the interview for the income question, she made its routine nature felt by asking it easily and naturally.

Hospital Coverage by Interviewers

At hospitals where the average number of admissions for whom consent was received was between 20 and 25 per day, the work load was heavy enough to keep one interviewer busy. If a hospital averaged fewer than 20 such patients per day, part of her time could be used elsewhere in the study; but if a hospital had between 26 to 34 per day, 34 being the highest daily average at any hospital in the study, two interviewers were needed. Week-end coverage was advisable, and in the larger hospitals it was essential, to keep current.

By and large, interviewing was done during nonvisiting hours in order not to intrude on a patient's time with family and friends. However, with patients who had a hearing or a language handicap, with child patients, and with adults who preferred to have the economic head of the household interviewed, it was necessary to see the responsible visitor. Often this entailed evening work.

Loss of Short-Term Patients

The time lag between admission of a patient and receipt of the physician's consent was a handicap. If a patient was admitted

Monday, then Thursday was the earliest the consent could be received at the study office, and Friday was the earliest day the interviewer could receive the questionnaire the office prepared. Although a majority of the physicians responded with reasonable speed, consent was received in 3 days from only 31 percent; 25 percent took 4 days; 16 percent, 5 days; and the remaining 28 percent, 6 days or more. Happily, 92 percent of the physicians gave blanket consent when they responded, thus clearing the way to all their later patients. But many of their earlier short-term patients could not be interviewed at the hospital because consent came too late.

To reduce the time lag, key physicians might have been asked for blanket consent before the interviewing period started. In most communities a number of physicians—a nucleus they might be called—have a considerable load of hospital patients. For example, in this study two physicians had 32 patients each; one had 28; two others had 23 each; another had 21; three had 20 each, and so on. It should not be difficult to discover in advance who these physicians are and, through a channel like the medical society, obtain their blanket consent in advance.

Another type of time lag proved to be an obstacle to reaching the shortest-term patients by interview. The study office received the patient's name from the hospital the day after he was admitted and, if the physician's blanket consent had already been given, prepared a questionnaire and sent it to the interviewer either late the same day or early the next. This meant that even with the physician's consent on file in advance of the patient's admission, it was the second day after his admission before the interviewer could approach him. The result was interview loss of almost all the 1-day and many of the 2-day patients.

A better method would have been to have the interviewer start at the hospital supplied with blank questionnaires and a card index of the attending physicians who had by then given blanket consent, with the study office sending her names of additional physicians day by day as new blanket consents came in. By matching against her index the names of physicians whose patients had been admitted each day, the interviewer could reach the patients more promptly. This system was tried at one of the last hospitals to be covered, where there were many very short-term admissions, and it enabled the interviewer to reach even a number of the 1-day patients.

For all hospitals in the study, only 7 percent of the 1-day patients and 13 percent of the 2-day patients were interviewed in contrast with 37 percent of the 3-day and 52 percent of the 4-day patients. By way of further contrast, 73-percent coverage was achieved among patients with a stay of 5 days or more. Fortunately, the bias against short-term patients was reduced to minor proportions by response to

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the questionnaire mailed to all patients who were not reached at the hospital. The average length of stay among patients in the study (interview and mailed questionnaire) was 7.4 days, only 0.8 day more than that among all patients admitted during the study period.

The Questionnaire

On the whole, the questionnaire worked well. Although it was on hectograph paper, it stood up under handling; and the use of medium hard pencils prevented smudging. Double spacing between lines was a help to the interviewers in writing the entries at patients' bedsides. Legibility was important later in editing and coding the data.

The discussion which follows takes up the individual items which are deserving of some comment, both those that are on the present form and some that would be on it if a similar study were done again.

Year of Birth

Although the original intent was to obtain year of birth from the patient, none of the hospitals objected to supplying this information from their records, thereby obviating one question that can sometimes be more embarrassing than any other.

Admission Date, Room Number, Name of Admitting Physician

Aware that the average length of patient stay in the hospitals in this study was a matter of days, the interviewer kept her eye on the patient's admission date and endeavored to see him as soon as possible after she had been notified of the physician's consent. To avoid loss of time in going from one part of the hospital to another, the interviewer tried to see patients floor by floor and section by section and arranged her pending interview sheets according to the patients' location. For easy reference in several stages of the study, it was useful to have the name of the admitting physician at hand.

Space had not been designated on the questionnaire for the admission date, location, or physician's name. (The "Date" space was for date of interview and the "Number" space for a number indicating numerical sequence in the study.) However, all three items were needed, and the study office entered them along with the name of the hospital and of the patient when it initiated the questionnaire from data on the daily hospital lists. Properly labeled spaces should have been provided at the top of the schedule for quick reference.

Home Address and Telephone Number

Work had not progressed far before it was realized that these two pieces of information were needed on the questionnaire for identification and contact in later stages of the study. The home address was entered by the study office from the data on the daily hospital lists.

Telephone numbers were obtained later, through directories and information service, for patients with whom it was necessary to get in touch to clarify an anomaly or complete an omission in data about their illness (approximately 200 such cases), or to learn the amount of benefit payments received by those who carried commercial insurance or Blue Cross other than Group Hospitalization, Inc. (about 400 of these cases). Looking up the telephone numbers of some 600 patients delayed the editing process. In the long run, time would have been saved had numbers been obtained from hospital records available to the study staff.

Occupation and Industry

Coding these items, which in a study such as this really means grouping them into broad categories, was more difficult than getting the information. The distinction between manager and foreman, between trade and manufacturing, and so on, is often hard to make. Although there were personal misgivings in some instances, the classifications of the Bureau of the Census and of the Social Security Board (now Administration) were followed closely (*2*, *3*).

Persons in Family

The difficulty was to define "family"—a problem not unknown to other studies, but magnified here because of the many older patients who made their homes with married sons or daughters. Here the pooling of income was made the principal criterion for determining what constituted the family composition.

Annual Family Income

The family income had to be the sum total of the incomes of all persons included in the family count. As is apparent from the questionnaire, the patient was asked to indicate into which of five brackets the family income fell. It was feared that the direct query might cause too many patients to balk.

Wives occasionally did not know the husband's income. This was best dealt with by having the interviewer ask the husband, often in the evening. Another problem was guarding against the tendency to understate income. For the interviewer even to seem to question the veracity of the respondent is out of bounds. Much depends on how able she is in communicating to him the completely confidential nature of all personal data in the study results.

Estimated Loss of Earnings From the Illness

A patient is likely to have found out from his physician how soon he can get back to work. Persons on wages or salary generally know

whether they will be carried at full pay or how much deduction will be made. When the patient cannot answer readily, the interviewer can help by listening to his description of his particular circumstances and raising an occasional question to obtain salient facts.

A perplexing situation arises when the patient is in an acute stage of a chronic illness which has caused and may still cause long unemployment. For this type of case the study should establish specific cut-off dates. The interviewer must be careful not to give the patient the impression that anyone would unsympathetically consider his total expenses as actually thus limited, and it is well not to mention dates to him if the needed information can be deduced accurately from his recital of facts.

Obstetrical cases present a special problem because, in identical circumstances, some women consider they are losing wages during pregnancy, and others do not. A reasonable definition would seem to be that if a woman has not resigned and if she fully intends to return to her job within a few weeks after the child's birth, her loss of wages shall be considered as part of the cost of sickenss, but otherwise not.

Consumption of sick leave or any similar benefit was not counted. Disability or unemployment compensation was of course deducted from loss of earnings.

Medical and Hospital Bill

The original intent had been to apportion the charges in each case among the categories shown, but it was almost immediately apparent that this would not work. It would have been better to separate payment by the individual from payment by some insurance plan as two discrete subjects for analysis.

In this particular study, in which 76 percent of the patients had incomes of more than $3,000 and 70 percent had some kind of insurance, only a negligible number indicated they would have to raise money by borrowing or by sale of personal effects. Nevertheless, the questions are important and at other times and in other circumstances might yield highly significant information.

To simplify entering, editing, and coding of data, names of the nonprofit insurance plans in the locality should be specifically named, and there should be two additional spaces labeled Blue Cross and Blue Shield, respectively, to cover patients who carry one or both from a State other than that of the study. Obviously, there are too many commercial companies selling a cash benefit type of plan to list them by name on a questionnaire of this length, and the generic heading suffices. Because of the wide range of policies now offered the public and the large number of policies held—17 percent of all the patients in this study—type and extent of coverage should be learned,

whether hospital only, physician only, hospital and physician, for loss of salary, and so on.

Illness Costs Outside of Hospital (Excluding Physician)

In this study a hospitalized illness was defined as including the month preceding and the month succeeding the period of hospitalization. For the most part, patients knew the costs which had been incurred by their illness in the past month and could closely estimate the coming month. The patient was asked to itemize the expenditures. In many cases the half line allowed was too short for the interviewer to write the items and amounts named, and she had to wedge them in as best she could. A half dozen or so short spaces labeled to cover the items most commonly expected would have been better. In this study the common items, exclusive of physician fees, were medicines, laboratory work, X-ray, domestic service, and ambulance.

This question excluded physician fees because these were obtained from the physician and not from the patient. However, it would have been advisable to ask the patient the names of physicians, if any, who had treated him in addition to the admitting physician, in order to have leads to referring physicians.

Charges for Hospital and Related Services

The individual items under this heading matched fairly well the items on the hospital bill, except for ambulance which might be considered an illness cost outside the hospital. Information on charge for ambulance was, in fact, obtained from the patient in the interview. Though charges for special nursing were not a part of the hospital record, charges for meals furnished to the nurse were, and from these the number of nursing shifts was determined. This number was then multiplied by $10, the standard rate per nursing shift. The item of special diet could be omitted and electrocardiography put in its stead. In some hospitals, pathology is included in laboratory charges. Data on pathology charges had to be based, therefore, on the hospitals in which they could be validly determined.

ACKNOWLEDGMENTS

We are deeply grateful to the physicians and hospitals who cooperated in the study and really made it possible, and to the 1,800 patients who so willingly gave information that was after all quite private in nature. Only with the full cooperation of these groups can a study of this kind be carried out successfully.

Our special thanks go to Theodore Wiprud, Executive Director of the Medical Society of the District of Columbia, who suggested the study and fathered it to completion; to George St. J. Perrott, Chief, Division of Public Health Methods, Public Health Service, who assigned personnel to the study; to Dr. Antonio Ciocco, Chairman, Department of Biostatistics, Graduate School of Public Health, University of Pittsburgh, for helpful advice throughout the study; and to the men and women who actually did the work.

REFERENCES

(1) Wiprud, Theodore, and Altman, Isidore: Cost of hospitalized acute illness. J.A.M.A. **144:** 835–839 (1950).

(2) U. S. Department of Labor. Dictionary of Occupational Titles. U. S. Government Printing Office, Washington, D. C., 1939.

(3) Federal Security Agency, Social Security Board. Industrial Classification Code. Vol. I. Description of Industries. Federal Security Agency, Washington, D. C., 1942.

APPENDIX A

MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA
MEDICO-CHIRURGICAL SOCIETY OF THE DISTRICT OF COLUMBIA

MEDICAL-HOSPITAL COST STUDY

This Information Is Confidential—For Statistical Purposes Only

.... Hospital Date .... No. ....

Name .... Sex (M or F) .... Year of birth ....

Occupation and industry .... Job, before illness ....

Occupation and industry of household head .... Employed or seeking work (H. H.) ....

Persons in family : 18 years and older .... Under 18 years ....

Annual family income (check appropriate box):

Under \$3,000 ☐ \$5,000–\$7,499 ☐ \$10,000 and over ☐

\$3,000–\$4,999 ☐ \$7,500–\$9,999 ☐

Est. loss of earnings from this illness ....

Medical and hospital bill paid by:

.... Patient from income or savings

.... Patient by borrowing

.... Patient by sale of personal effect or property

.... Other individual not in family (gift)

.... Blue Cross

.... Medical Service of the D. C. plan

.... Other prepayment service plan

.... Cash benefits plan

.... Other (specify) ....

....

Illness costs outside of hospital (excl. physician) ....

Number of other times members of family have been hospitalized in last 12 months ....

Permission for the above hospital to supply information on its charges is hereby granted.

....
Patient's signature

CHARGES FOR HOSPITAL AND RELATED SERVICES

Total ....

Room and board	Anesthesia ....
Laboratory	Pathology ....
Drugs	Radiology ....
Operating room	Special nursing ....
Special diet	Ambulance ....
Transfusions	Other (specify) ....
Days in hospital	Days of specia nursing ....

APPENDIX B

THE MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA
MEDICO-CHIRURGICAL SOCIETY OF THE DISTRICT OF COLUMBIA

MEDICAL-HOSPITAL COSTS STUDY

This Information Is Confidential—For Statistical Purposes Only

Patient	Hospital admission date	Fees charged for this illness	Amount received from any medical or surgical plan	Type of case S, M, or O*	Physician who referred this case

*S=surgical; M=medical; O=obstetrical.

An Outbreak of Q Fever in Sokol, Yugoslavia, August 1950

By Edward S. Murray, M.D.,* Predrag Djaković, M.D.,† Franja Ljupša,† and John C. Snyder, M.D.*

Q fever had been reported up to 1950 from Australia (*1*), North America (*2–5*), Panama (*6, 7*), Western Europe (*8–13*), the Middle East (*14–16*), the Mediterranean area (*17–20*), and South Africa (*21*).

With Q fever already recognized in so many countries, particularly those of the Mediterranean littoral, it would be reasonable to expect this disease to occur in Yugoslavia. While our present study was in progress, we learned that Jovanović et al. (*22*) had published a report on Q fever in Yugoslavia. This paper has not been available to us for review. The present paper reports the serological findings in 10 individuals from an outbreak clinically resembling Q fever which occurred in Sokol, a village in Bosnia, Yugoslavia, during August 1950.

Clinical Observations

During July and August of 1950 we were investigating fevers of unknown origin in Bosnia, Yugoslavia. At the time we were primarily interested in sporadic cases of recrudescent typhus; however, on August 11, 1950, a man, A. P., from the village of Sokol appeared in the dispensary of Dr. Djaković in Gračanica (some 6 miles from Sokol) complaining of chills, headache, and malaise of some 6 days duration. His temperature was 39.1° C. orally in the dispensary. On questioning, he stated that a large number of people in his village were similarly sick. Obviously, this illness was different from the typically sporadic cases of Brill's disease we were investigating.

On the evening of the same day we visited Sokol, high up in the hills, and found that at least a dozen people were sick in their homes, complaining of chilliness, headache, and general aching. Only one patient complained of cough; none complained of chest pain.

Six of these patients we examined and questioned fairly carefully before drawing blood. Four more patients, some of whom were ambulant, were questioned superficially before blood specimens were taken. With one exception the symptoms of individuals in this latter group were similar to those of the original five patients ques-

*Department of Microbiology, Harvard University School of Public Health, Boston, Mass. †From Gračanica and Doboj, Bosnia, Yugoslavia, respectively. This work was supported by grants from the Division of Research Grants and Fellowships of the National Institutes of Health, Public Health Service, and the Lederle Laboratories Division of the American Cyanamid Co., and was conducted with the aid of the Commission on Virus and Rickettsial Diseases, Armed Forces Epidemiological Board, Office of the Surgeon General, U. S. Army, Washington, D. C.

Table 1. *Clinical findings in 10 individuals from an outbreak of Q fever, Sokol, Yugoslavia, August 1950*

Name	Age	Sex	Symptoms and signs: Acute phase[1] temp. C., Aug. 11, 1950	Chills	Malaise	Head-ache	Palpa-ble spleen	Rash	Miscellaneous complaints
B. V.	48	M	39.2	+	+	+	(–)	(–)	Dry cough, vertigo.
B. H.	54	M	38.8	+	+	+	(–)	(–)	Constipation.
A. P.	45	M	39.1	+	+	+	(–)	(–)	
B. Ag.	30	M	38 3	+	+	+	(–)	(–)	
B. Ad.	50	M	38 0	+	+	+	(–)	(–)	Claimed he felt better 8/10/50.
N. Ib.	46	M	37.0	+	+	+	N. T.	N. T.	Claimed he became well 8/10/50.
N. M.[2]	33	M	----------	--------	--------	--------	--------	--------	
F. Hat.[2]	20	F	----------	--------	--------	--------	--------	--------	
F. Han.[2]	56	F	----------	--------	--------	--------	--------	--------	
N. Z.[3]	50	F	----------	--------	--------	--------	--------	--------	

1 Temperatures axillary.
2 These three patients were only briefly questioned without examination.
3 History of vague illness 2 months previously; patient not examined. N. Z., wife of N. Ib.
N. T.=Not tested.

tioned; the one exception was a woman, N. Z., who gave only a vague story of illness 2 months previously with no present complaints. The clinical data are presented in table 1.

As we left the village, at least a half dozen other people stopped us and recited symptoms similar to those of the patients in the first group we had examined. We were importuned by still others to visit their reputedly sick relatives or friends. We estimated that on August 11 about 50 persons were sick in this village of approximately 400 inhabitants. Apparently, all those who were ill were adults, with males in the majority. No certain cases of the disease in children were seen, although a thorough examination with temperature recordings was not made. The onset of illness seemed fairly well confined to the period from August 1 through August 8.

Eleven days later, on August 22, 1950, we returned to the village and took a second specimen of blood from each of the same 10 individuals. At this time all 10 were ambulant and those previously ill claimed they had recovered (though a few did complain of mild headache and/or weakness). There seemed to be no new cases and villagers stated that their sick were all now back at work in the fields.[1]

Materials and Methods

The first serum specimens were taken August 11, 1950, during the first 10 days of the outbreak while most of the patients were still in the acute phase of their illness. The second set of serum specimens was taken 11 days later on August 22, at which time the outbreak had sub-

1 Epidemiologic studies on this outbreak are being undertaken by Drs. Šimović, Gaon, Vesenjak, et al. in Yugoslavia and will be reported in another communication.

sided, and the 10 patients being tested were apparently well or convalescent. A third, later convalescent specimen was obtained September 19, 1950, from two of the patients, B. V. and B. Ag.

Phenyl mercuric borate was added to the serum as a preservative in a final concentration of about 1/20,000. The serum was at first stored at +5° C. for about 2 weeks in Yugoslavia, then transported without refrigeration during 3 days by air from Yugoslavia to the United States; subsequently it was stored at −20° C.

In our tests serial twofold dilutions of the serum beginning with 1/10 were titrated with Q fever antigen following the method of the Army Medical Department Research and Graduate School (*23*). The only modification was the replacement of saline as a diluent by a magnesium buffer as described by Mayer et al. (*24*).

Results

Complement Fixation Titers With Q Fever Antigen

The results of the tests are summarized in table 2. Of the nine patients in the acute phase (3d to 10th day) of the disease, eight had negative titers with Q fever antigen while one had a 1/40 titer. Convalescent sera taken 11 days later showed a rise of titer in all nine cases with titers ranging from 1/20 to 1/640. Sera from two of the patients, B. V. and B. Ad., taken on the 44th and the 42d days after onset, had titers of 1/160 and 1/320, respectively.

The sera of N. Z., who had no symptoms at any time during the August epidemic but reported a vague illness two months previously, were negative in both first and second specimens. This subject was the wife of N. Ib.

Table 2. *Complement fixation tests on sera from 10 individuals in an outbreak of Q fever in Sokol, Bosnia, Yugoslavia, August to September 1950*

Patient	Onset of illness	Complement fixation with Q fever antigen [1]					
		1st specimen Aug. 11, 1950		2d specimen Aug. 22, 1950		3d specimen Sept. 19, 1950	
		Day of disease	Serum titer [2]	Day of disease	Serum titer	Day of disease	Serum titer
B. V.	Aug. 6	5	0	16	1/20	44	1/160
B. H.	Do.	5	0	16	1/80		
A. P.	Aug. 5	6	0	17	1/320		
B. Ag.	Aug. 8	3	0	14	1/320	42	1/320
B. Ad.	Aug. 3	8	0	19	1/320		
N. Ib.	Aug. 1	10	0	21	1/80		
N. M.	Aug. 4	7	1/40	18	1/640		
F. Hat.	Aug. 8	3	0	14	1/40		
F. Han.	Aug. 7	4	0	15	1/320		
N. Z [3]	?		0		0		

[1] Authors are indebted to H. R. Cox, Director, Section of Viral and Rickettsial Research, Lederle Laboratories, for the Q fever antigens used in these tests. The Italian Henzerling strain was employed.
[2] The figure zero means that no fixation was observed at the first dilution tested which was 1/10 for all sera in this table. These tests were performed by Avis Ofstrock.
[3] Vague illness 2 months previously; N. Z., wife of N. Ib.

Complement Fixation Titers With Other Rickettsial Antigens

All the patients gave a history of having had epidemic louse-borne typhus fever during World War II, 1941–45, and all had low residual titers with epidemic typhus antigen. There were two individuals with epidemic titers of 1/80, three with 1/40, and five with 1/10 or 1/20. One individual had a barely detectable murine complement fixation titer of 1/10 in both acute and convalescent serum specimens, but in this case the epidemic titer was eightfold higher. All 10 individuals showed a negative ($<1/10$) complement fixation titer of antibodies with the rickettsialpox antigen in both acute and convalescent serum specimens.

Discussion

Robbins et al. (*17*) found that complement fixation antibodies to Q fever were usually not demonstrable during the first week of the disease. The rise usually began about the middle of the second week of illness. In the sera tested from the nine patients from the outbreak in Sokol, Yugoslavia, there was a marked rise in titer with Q fever antigens between the acute (August 11, 1950) and convalescent (August 22, 1950) phase sera; this is typical of the serological results obtained in other outbreaks of Q fever.

All 10 individuals had typhus fever during the World War II typhus epidemic in Bosnia; and all 10 showed complement fixation titers ranging from 1/10 to 1/80 with the epidemic antigen; acute and convalescent specimens from the same individual had identical titers. Studies on the long persistence of complement-fixing antibodies to epidemic typhus will be reported elsewhere (*25*). In any case, two facts are apparent: (a) A previous attack of epidemic typhus, as evidenced by the presence of a low residual titer of epidemic complement-fixing antibodies, did not seem to offer any protection against infection with Q fever; (b) individuals possessing a low residual titer of epidemic complement-fixing antibodies did not develop an anamnestic response of this epidemic typhus antibody when they suffered an attack of Q fever.

This evidence that immunity to epidemic typhus offers no protection against Q fever agrees with a report by Huebner et al. (*26*) who state that typhus vaccination in a group of laboratory workers apparently had little or no influence in protecting these individuals during an outbreak of Q fever in the National Institutes of Health laboratory outbreak in 1945–46.

The absence of any anamnestic response of typhus antibodies in these patients is in agreement with the studies of Zarafonetis (*27*) who found that the antibody titers of typhus-vaccinated individuals did not rise during the course of nontyphus febrile attacks.

The Sokol area of Bosnia has a high incidence of endemic syphilis,

and it is possible that some of these 10 individuals may have had syphilis. However, Strauss and Sulkin (*28*) studied some 1,433 serum specimens, 114 (8 percent) of which had 1/8 or higher titers with Q fever antigen and 39 of which had positive Kahn and/or Kohlmer tests. Their findings suggested no direct relationship between serum activity with antigens from syphilis and Q fever. Hence any possibility of concomitant *Treponema pallidum* infection does not appear to explain the marked rise in Q fever antibodies in this Sokol outbreak.

Summary

1. Complement fixation tests with Q fever antigen were performed on the acute and convalescent phase sera of nine individuals from an epidemic characterized by fever, headache, and malaise in the village of Sokol, Bosnia, Yugoslavia, in August, 1950. All nine individuals showed a marked rise in Q fever antibody titers in their convalescent serum specimens confirming the clinical impression that this was an outbreak of Q fever.

2. Nine individuals giving a history and serologic evidence of past infection with epidemic typhus developed what appeared to be typical Q fever. Apparently, past infection with epidemic typhus offers very little or no protection against Q fever.

3. In nine individuals with a positive history and serologic evidence of past infection with epidemic typhus, a subsequent Q fever infection caused no anamnestic rise of the residual epidemic typhus antibody titers.

REFERENCES

(*1*) Derrick, E. H.: "Q" fever, a new fever entity: Clinical features, diagnosis, and laboratory investigation. Med. J. Australia **2:** 281–299 (1937).

(*2*) Shepard, C. C., and Huebner, R. J.: Q fever in Los Angeles County. Description of some of its epidemiological features. Am. J. Pub. Health **38:** 781–788 (1948).

(3) Topping, N. H., Shepard, C. C., and Irons, J. V.: Q fever in the United States. I. Epidemiologic studies of an outbreak among stock handlers and slaughterhouse workers. J. A. M. A. **133:** 813–815 (1947).

(*4*) Shepard, C. C.: An outbreak of Q fever in a Chicago packing house. Am. J. Hyg. **46:** 185–192 (1947).

(*5*) Goytia, R. S.: Fiebre Q en Mexico. Rev. Med. de Mexico **30:** No. 615 (1950).

(*6*) Cheney, G., and Geib, W. A.: The identification of Q fever in Panama. Am. J. Hyg. **44:** 158–172 (1946).

(*7*) De Rodaniche, E. C., and Rodaniche, A.: Studies on Q fever in Panama. Am. J. Hyg. **49:** 67–75 (1949).

*(*8*) Gsell, O.: Q-fever (Queenslandfieber) in der Schweiz (endemische Pneumonien durch *Rickettsia burnetti*). Schweiz. med. Wchnschr. **78:** 1–8 (1948).

*(*9*) Heni, E., and Germer, W. D: Q-Fieber in Deutschland. Deutsche med. Wchnschr. **73:** 472–476. (1948).

*(10) Stoker, M. G. P.: Serological evidence of Q fever in Great Britain. Lancet **1**: 178–179. (1949).

*(11) de Prada, J.: La Fiebre "Q" en España. Med. Colonial (Madrid) **14**: 471–495 (1949).

*(12) Bertrand-Fontaine, Schneider, J., and Rivron. J.: Premier cas de "Q Fever" (maladie de Derrick-Burnett) observé à Paris. Bull. et mém. Soc. méd. d. hôp. de Paris Nos. 32/33: 1432–1437 (1949).

*(13) Fonseca, F., Pinto, M. R., de Azevedo, J. F., and Lacerda, M. T.: Febre Q em Portugal. História: Observações Clinicas: Diagnóstico. Clínica Contemporanea **3**: 1159–1164; 1218–1227; 1257–1271 (1949).

*(14) Combiesco, D., Vasiliu, V., and Dumitresco, N.: Identification d'une nouvelle rickettsiose chez l'homme en Roumanie. Compt. rend. Soc. de biol. **141**: 716–717 (1947).

*(15) Payzin, S., and Golem, S. B.: Tűrkiye'de Q Hummasi (Rapor 1). Tűrk Iji. Tec. Biyol. Der. **8**: 94–113 (1948).

*(16) Klopstock, A., Klopstock, E., and Rosenkranz, G.: First diagnosed outbreak of Q-fever in Israel. Harefuah **37**: July 1, 1949.

(17) Robbins, F. C., Gauld, R. L., and Warner, F. B.: Q fever in the Mediterranean area: Report of its occurrence in allied troops. II. Epidemiology. Am. J. Hyg. **44**: 23–43 (1946).

*(18) Caminopetros, J.: La Broncho-pneumonie Épidémique hiverno-printanière, Humaine et Animale (Chèvre, Mouton), Fièvre Q ou Grippe des Balkans, à *Rickettsia burneti* var. *caprina*, les Caractères Particuliers de l'infection Animale. Ann. Inst. Pasteur **77**: 750–756, (1949).

(19) Lengrand, J.: Nouvelle Observations de Q Fever Faite dans les Environs d'Alger. Bull. Acad. nat. méd. **132**: 251–253 (1948).

*(20) Blanc, G., Martin, L. A., and Maurice, A.: Le Mérion (*Mériones shawi*) de la Région de Goulimine est un Réservoir de Virus de la Q Fever Marocaine. Compt. rend. Acad. d. sc. **224**: 1673–1674 (1947).

(21) Gear, J. H. S., Wolstenholme, B., and Cort, A.: Q fever: Serological evidence of the occurrence of a case in South Africa. South Africa Med. J. **24**: 409–411 (1950).

(22) Jovanović, L., Kičić, M., and Radojičić, B.: Prva Epidemija Q Groznica u Jugosloviji. Voj. San. Pregl. **7**: 82–93 (1950).

(23) Plotz, H., Bennett, B. L., Wertman, K., Snyder, M. J., and Gauld, R. L.: The serological pattern in typhus fever. I. Epidemic. Am. J. Hyg. **47**: 150–165 (1948).

(24) Mayer, M. M., Osler, A. G., Bier, O. G., and Heidelberger, M.: The activating effect of magnesium and other cations on the hemolytic function of complement. J. Exper. Med. **84**: 535–548 (1946).

(25) Murray, E. S., Cohen, S., and Snyder, J. C.: To be published.

(26) Huebner, R. J.: Report of an outbreak of Q fever at the National Institute of Health. II. Epidemiological features. Am. J. Pub. Health **37**: 431–440 (1947).

(27) Zarafonetis, C. J.: Serologic studies in typhus-vaccinated individuals. II. The effect of non-typhus fevers on the Weil-Felix and complement-fixing antibodies. J. Immunol. **51**: 375–388 (1945).

(28) Strauss, E., and Sulkin, S. E.: Studies on Q fever: Complement-fixing antibodies in meat packers at Fort Worth, Texas. Proc. Soc. Exper. Biol. and Med. **67**: 139–141 (1948).

*References cited from Tropical Diseases Bulletin.

Statistics on Premature Births and Neonatal Mortality

In December 1950, a joint statement entitled "Recommendations for Developing Comparable Statistics on Prematurely Born Infants and Neonatal Mortality," was issued by the following organizations: Public Health Conference on Records and Statistics; Association of Maternal and Child Health and Crippled Children Directors; Children's Bureau and the National Office of Vital Statistics of the Federal Security Agency. Since then the report has received wide circulation among many groups interested in these statistics.

An important achievement of medical science and public health measures over the past few decades has been the marked reduction in infant mortality. The advance, however, has been much greater in the group surviving the first few days of life than among the newborn, and in recent years a major portion of the infant deaths have occurred shortly after birth. The situation has focused attention on the need for intensified investigation of factors related to immaturity, the condition associated with most of the deaths in early infancy.

Practically all certificates of birth now in use in this country contain items on "birth weight" and "weeks of gestation." Combining data from matched birth and death records would provide information needed to determine the relative chances of survival in various birth-weight groups and changes in the mortality rates that occur over a period of time.

The usefulness of statistics on immature (or prematurely born) infants and neonatal mortality for national and State planning depends to a great extent on the comparability of the data collected and tabulated. Recommendations in the report cover definitions, improvement in source data, classification groups for several critical items, and derivation of statistics from matched birth and infant death certificates.

Copies of the statement can be obtained by writing to the National Office of Vital Statistics or the Children's Bureau, Washington 25, D. C.

Recommendations for tabulation of statistics on immaturity and neonatal mortality needed nationally and locally are now being drawn up by the organizations listed in the first paragraph. These will include (a) specifications for the collection by the National Office of Vital Statistics of data prepared by State offices to make available national and regional statistics and (b) suggestions for the tabulation of a minimum set of data by State offices for their own programs.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended July 21, 1951

The number of cases of poliomyelitis increased about 30 percent, from 592 last week to 773 for the current week. For the same week last year, 802 cases were reported. The cumulative total since the seasonal low week is 3,360 and 4,535 for the calendar year. The corresponding figures for 1950 were 3,893 and 4,995, respectively. The above data exclude Missouri and Pennsylvania from which no reports were received for the current week.

The geographic regions which showed substantial increases in number of cases for the current week as compared with last week were the East South Central and the Mountain States. The total number reported in the West South Central declined from 155 last week to 148 for the current week. In this region, Texas showed a marked decrease from 92 to 66 cases, while in Louisiana there was a moderate increase from 29 to 41 cases.

New York State reported 52 cases for the current week, 17 of which were in New York City, as compared with 26 for the previous week in the State as a whole. All of the East South Central States reported increases as compared with the previous week, especially Kentucky and Mississippi. The number of cases in the Mountain States increased from 33 last week to 82 for the current reporting period, nearly all of the increase taking place in Colorado and Utah.

Dr. G. W. Cox, Texas State Health Officer, on July 19 stated that only three counties have shown an increase in incidence of poliomyelitis this year as compared with 1950. The total reported incidence on July 19 was 84 cases in Nueces County, 27 in San Patricio, and 9 in Grayson, as compared with 30, 9, and 3 cases, respectively, last year.

Dr. C. C. Kuehn, Louisiana Department of Health, on July 17 stated that 57 paralytic and 14 nonparalytic cases of poliomyelitis had been reported from Shreveport this year. Thirty-nine of the paralytic cases have been in nonwhite persons, 5 of which were under 1 year of age; 18 were in the 1–4-year age group, and 13 were 5–14 years old. Two deaths from the disease occurred in Caddo Parish.

In California, the disease has been concentrated in counties around the San Francisco Bay area and in and around Los Angeles. In Colorado, the latest report indicates a concentration in Denver and in contiguous counties. In Illinois, most of the cases have occurred in the northern part of the State. In Wisconsin, about half of the cases reported were in Milwaukee; and in Michigan, more than half have been reported from Detroit. In Massachusetts, a large proportion have been in the eastern part of the State. In Georgia and Alabama, about half of the cases have occurred in large cities.

Epidemiological Reports

Smallpox

Information regarding the case of smallpox reported last week in Kentucky has been received from Dr. Emil Kotcher, Kentucky State Department of Health. The patient was a 57-year-old farmer in Union County who had been vaccinated when a young boy but not since then. He had a history of chickenpox many years ago. No association with a recent case of smallpox could be found.

Anthrax

Dr. Kotcher reports that an epizootic of anthrax is occurring in Fulton and Hickman Counties which are in the extreme southwestern part of Kentucky. The epizootic beginning in May has affected horses, cattle, and swine in considerable numbers. Two counties in Kentucky have been quarantined and animals are being vaccinated. Thus far, no human cases have been reported. According to the Bureau of Animal Industry of the U. S. Department of Agriculture, approximately 100 animals, mostly mules, have been affected in Lake County in northwestern Tennessee. The State Department of Health also reports a small outbreak in Lauderdale County. Anthrax in animals was last reported in this region in 1947.

Infectious Hepatitis

Dr. C. R. Freeble, Ohio Department of Health, has reported a localized outbreak of infectious hepatitis in Lorain County which has been in progress since January. Dr. M. T. Fisher, County Health Commissioner, reported that 32 cases had come to his attention between January 26 and May 11. Eighteen of the cases were females and 14 were males. The youngest case was 4 years old and the oldest, 57 years, but more than half were between the ages of 5 and 15. Nineteen attended the local school. Multiple cases occurred in several families, and in one household there were six cases.

Gastroenteritis

The New York State Department of Health has reported two outbreaks of food poisoning in which ham was found to be the vehicle

of infection. One outbreak, which was investigated by Dr. C. M. Steward, occurred in the northern part of the State about the middle of June. Ten cases followed the eating of baked ham sandwiches in a local restaurant. The meat had not been kept refrigerated. The second outbreak, investigated by Dr. Dudley Hargrave, occurred June 23 in persons attending a picnic. Five to six hours after eating ham sandwiches, 23 persons became ill out of a total of 500 attending the picnic. The sandwiches had stood several hours unrefrigerated. In both instances a hemolytic staphylococcus was recovered from specimens of the meat.

Human Rabies

Dr. L. E. Burney, Indiana Commissioner of Health, has reported the first case of human rabies in Indiana in 1951. The victim was an 18-year-old girl who resided in Henry County. She was bitten in April and died of rabies in July. There have been eight laboratory-confirmed cases of animal rabies in Henry County since January 1.

Keratoconjunctivitis

Dr. H. M. Erickson, Oregon State Health Officer, has reported an outbreak of keratoconjunctivitis in Douglas County. A total of 22 cases has been found, 18 of which were in males, and 16 were of school age. Only 2 cases have been reported from the same address, but 17 were residents of Roseburg or its suburbs. The Roseburg municipal swimming pool is suspected as the source of spread for these cases.

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	July 21, 1951	July 22, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	-------	1	-------	(1)	(1)	(1)	(1)	40	27	31
Diphtheria (055)	38	63	107	27th	78	123	194	2,086	3,251	4,806
Encephalitis, acute infectious (082)	17	23	16	(1)	(1)	(1)	(1)	506	421	299
Influenza (480–483)	208	196	210	30th	130,355	149,147	149,147	115,813	138,563	128,320
Measles (085)	4,394	3,418	3,418	35th	484,135	299,082	574,526	455,434	279,952	539,597
Meningitis, meningococcal (057.0)	64	50	53	37th	3,597	3,363	3,248	2,636	2,450	2,276
Pneumonia (490–493)	450	662	(2)	(1)	(1)	(1)	(1)	44,066	57,772	(2)
Poliomyelitis, acute (080)	773	826	826	11th	[3] 3,420	4,013	4,013	[3] 4,632	5,144	4,580
Rocky Mountain spotted fever (104)	16	21	32	(1)	(1)	(1)	(1)	175	236	260
Scarlet fever (050)[4]	421	316	428	32d	[5] 68,079	55,818	79,517	[5] 52,388	39,379	56,973
Smallpox (084)	1	-------	-------	35th	17	43	68	9	23	47
Tularemia (059)	18	22	24	(1)	(1)	(1)	(1)	387	568	592
Typhoid and paratyphoid fever (040,041)[6]	71	100	100	11th	880	1,186	1,212	1,315	1,696	1,697
Whooping cough (056)	1,249	2,468	2,245	39th	[7] 64,460	98,106	84,652	[7] 42,858	76,570	55,284

[1] Not computed. [2] Data not available. [3] Deductions: Kentucky, week ended February 3, 1 case; Mississippi, week ended July 7, 1 case. [4] Including cases reported as streptococcal sore throat. [5] Deduction: Rhode Island, week ended July 14, 10 cases. [6] Including cases reported as salmonellosis. [7] Addition: Rhode Island, week ended July 14, 10 cases.

NOTE.—Data exclude figures for Missouri and Pennsylvania for week ended July 21, from which no reports were received.

Reported Cases of Selected Communicable Diseases: United States, Week Ended July 21, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**38**	**17**	**208**	**4,394**	**64**	**450**	**773**
New England	-	**1**	**1**	**380**	**3**	**21**	**30**
Maine	-	-	1	41	-	3	2
New Hampshire	-	-	-	10	-	1	1
Vermont	-	-	-	7	-	-	1
Massachusetts	-	1	-	244	2	-	17
Rhode Island	-	-	-	20	-	-	-
Connecticut	-	-	-	58	1	17	9
Middle Atlantic	**2**	**8**	**2**	**1,184**	**8**	**44**	**61**
New York	2	5	(1)	759	7	-	52
New Jersey	-	3	2	425	1	44	9
Pennsylvania [2]	-	-	-	-	-	-	-
East North Central	**7**	-	-	**1,033**	**11**	**53**	**152**
Ohio	2	-	-	137	5	-	26
Indiana	-	-	-	8	-	6	8
Illinois	2	-	-	245	4	35	52
Michigan	3	-	-	95	1	12	37
Wisconsin	-	-	-	548	1	-	29
West North Central	-	**3**	**12**	**123**	**7**	**38**	**43**
Minnesota	-	-	-	6	4	18	6
Iowa	-	2	-	35	2	2	17
Missouri [2]	-	-	-	-	-	-	-
North Dakota	-	-	8	33	-	12	1
South Dakota	-	-	-	8	-	-	1
Nebraska	-	-	-	21	-	-	9
Kansas	-	1	4	20	1	6	9
South Atlantic	**11**	-	**79**	**518**	**15**	**59**	**72**
Delaware	-	-	-	9	-	-	-
Maryland	-	-	1	210	1	22	2
District of Columbia	-	-	-	8	-	10	-
Virginia	1	-	74	182	-	20	9
West Virginia	-	-	-	27	2	-	2
North Carolina	8	-	-	25	7	-	4
South Carolina	2	-	2	6	-	1	4
Georgia	-	-	2	13	2	6	34
Florida	-	-	-	38	3	-	17
East South Central	**4**	**1**	**4**	**94**	**9**	**18**	**106**
Kentucky	-	-	1	17	1	4	12
Tennessee	-	-	-	28	6	-	21
Alabama	3	-	-	47	-	4	31
Mississippi	1	1	3	2	2	10	42
West South Central	**9**	**1**	**27**	**232**	**5**	**140**	**148**
Arkansas	2	-	11	21	-	14	20
Louisiana	1	-	-	15	-	18	41
Oklahoma	-	1	16	6	1	20	21
Texas	6	-	-	190	4	88	66
Mountain	**2**	**2**	**75**	**255**	**1**	**35**	**82**
Montana	-	-	-	51	-	1	1
Idaho	-	-	-	46	-	-	3
Wyoming	-	-	-	47	-	1	8
Colorado	-	-	7	20	-	7	43
New Mexico	1	-	1	18	-	16	1
Arizona	1	2	67	43	1	10	7
Utah	-	-	-	30	-	-	19
Nevada	-	-	-	-	-	-	-
Pacific	**3**	**1**	**8**	**575**	**5**	**42**	**79**
Washington	-	-	-	42	-	2	5
Oregon	-	-	6	120	1	9	4
California	3	1	2	413	4	31	70
Alaska	-	-	-	-	1	-	4
Hawaii	-	-	-	64	-	4	-

[1] New York City only.
[2] Reports from Missouri and Pennsylvania for week ended July 21, were not received.

Reported Cases of Selected Communicable Diseases: United States, Week Ended July 21, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Small-pox (084)	Tulare-mia (059)	Typhoid and para-typhoid fever [2] (040, 041)	Whoop-ing cough (056)	Rabies in animals
United States	**16**	**421**	**1**	**18**	**71**	**1,249**	**92**
New England		**37**			**8**	**44**	
Maine		6			2	24	
New Hampshire		1				2	
Vermont							
Massachusetts		21			5	15	
Rhode Island		3				1	
Connecticut		6			1	2	
Middle Atlantic		**86**			**2**	**136**	**3**
New York		78			1	71	3
New Jersey		8			1	65	
Pennsylvania [3]							
East North Central	**1**	**102**		**3**	**3**	**182**	**11**
Ohio		28				35	1
Indiana		7				15	7
Illinois		19		3	2	34	1
Michigan	1	37			1	40	2
Wisconsin		11				58	
West North Central		**16**	**1**			**56**	**10**
Minnesota		5				1	7
Iowa		3				28	2
Missouri [3]							
North Dakota						5	
South Dakota		1	1			1	
Nebraska							1
Kansas		7				21	
South Atlantic	**12**	**27**		**1**	**9**	**178**	**17**
Delaware						1	
Maryland	1	2			1	3	
District of Columbia		2			3	6	
Virginia	7	7		1	1	45	6
West Virginia		2				28	2
North Carolina	3	10			1	59	
South Carolina					1		5
Georgia	1				2	8	4
Florida		4				28	
East South Central	**1**	**34**		**3**	**16**	**93**	**26**
Kentucky		6			8	25	16
Tennessee		21		2	2	22	4
Alabama		4			4	24	4
Mississippi	1	3		1	2	22	2
West South Central		**16**		**9**	**19**	**376**	**24**
Arkansas		4		8	5	19	
Louisiana					2		
Oklahoma		4			1	34	2
Texas		8		1	11	323	22
Mountain	**2**	**26**		**2**	**6**	**83**	
Montana		3		1	2	5	
Idaho				1	4	11	
Wyoming	1	2				6	
Colorado	1	3				23	
New Mexico						11	
Arizona		4				24	
Utah		14				3	
Nevada							
Pacific		**77**			**8**	**101**	**1**
Washington		3			1	27	
Oregon		5				5	
California		69			7	69	1
Alaska							
Hawaii		4			4		

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.
[3] Reports from Missouri and Pennsylvania for week ended July 21, were not received.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended June 30, 1951

Disease	Total	New-foundland	Prince Edward Island	Nova Scotia	New Bruns-wick	Que-bec	On-tario	Mani-toba	Sas-katch-ewan	Al-berta	Brit-ish Co-lum-bia
Brucellosis	3					3					
Chickenpox	838	8		41	2	128	459	18	24	105	53
Diphtheria	5					2			3		
Dysentery, bacillary	11					2		4			5
Encephalitis, infectious	2					1			1		
German measles	219			8		3	88		8	41	71
Influenza	8			5	1						2
Measles	908	11		30	11	148	177	27	14	349	141
Meningitis, meningococcal	7					6	1				
Mumps	316	6		5	2	48	110	17	17	53	58
Poliomyelitis	13						11			1	1
Scarlet fever	262				1	81	41	39	23	32	45
Tuberculosis (all forms)	289	20		2	17	105	34	19	5	55	32
Typhoid and paratyphoid fever	31					10	1		5		15
Venereal diseases:											
Gonorrhea	232	2		5	12	65	49	33	22	44	
Syphilis	65			2	2	40	8		8	5	
Primary	10					8			2		
Secondary	5					3	1		1		
Other	50			2	2	29	7		5	5	
Whooping cough	104			2	2	22	38	6	3	17	14

CUBA

Reported Cases of Certain Diseases—5 Weeks Ended June 30, 1951

Disease	Total	Pinar Del Rio	Habana		Matan-zas	Santa Clara	Cama-guey	Oriente
			Habana City	Total				
Brucellosis	1			1				
Cancer	110	3		14	26	39	12	16
Chickenpox	25		10	13	5		6	1
Diphtheria	10		4	4	3	2		1
Leprosy	39			6	1	14	3	15
Malaria	22	2	1	1		1	1	17
Measles	32		13	16	1	1	12	2
Poliomyelitis	1							1
Tuberculosis	154	4		25	14	55	41	15
Typhoid fever	77	8	14	23	7	25	6	8
Whooping cough	3						3	
Yaws	2							2

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently. A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Cholera

Burma. There were only three cases of cholera reported in Mergui for the week ended July 14, 1951. For the previous 2 weeks a flare up of 18 and 21 cases was reported after a decrease of several weeks from the recent outbreak in May. One case of cholera was reported in Kyaukpyu for the week ended July 14.

Pakistan. During the week ended July 7, 1951, three cases of cholera were reported in Chittagong. For the week ended June 16, 109 cases (71 deaths) were reported in East Bengal Province.

Plague

Peru. Three cases (two deaths) of plague were reported in Cajamarca Department, Chota Province, during May 1951.

Smallpox

French West Africa. During the period June 21–30, 1951, 86 cases of smallpox were reported in Sudan and 43 cases were reported in Niger Territory.

India. During the week ended July 14, 1951, 21 and 9 cases of smallpox, respectively, were reported in the ports of Madras and Calcutta.

India (French). For the week ended June 30, 1951, Karikal reported 22 cases of smallpox and Mahe reported 3.

Typhus Fever

Morocco (French). For the period June 21–30, 1951, six cases of typhus fever were reported. These were the first cases since March when one case was reported.

1951 Census of Public Health Nurses

A gain of 5,000 public health nurses in the last 5 years, bringing the total to more than 25,000 nurses employed in public health work, is noted in the 1951 Census of Public Health Nurses, just issued by the Public Health Service.

Another important trend revealed by the census is that more nurses are better prepared for their work today than ever before. The new census gives breakdowns on educational qualifications and data on special consultants and other groups. It also indicates that 20 States and Territories now have public health nursing services in all their counties.

Copies of the 1951 census are available without charge at the Division of Public Health Nursing, Public Health Service.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

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It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price per year—$4.75, domestic; $6.25, foreign.

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Determination of Sodium and Copper Pentachlorophenates in Dilute Aqueous Solutions

By W. T. Haskins, Ph.D.*

Sodium and copper pentachlorophenates have shown considerable promise as molluscacides for the destruction of snail intermediate hosts of the human schistosomes (*1*, *2*, *3*). These snails are found in aquatic environments such as streams, irrigation ditches, swamps, and lakes. In field trials of the compounds in natural waters, the researcher should know the actual concentration prevailing at various locations throughout the body of water in order that he may correlate this data with other pertinent data. To be of optimum value, the analytical method should be usable in the field and hence should involve a minimum of equipment to facilitate portability. Since these compounds are effective at concentrations of 10 ppm. or less, the method should also be sensitive enough to detect 1 ppm. and versatile enough to include a range up to 100 ppm. without requiring extensive serial dilutions of the sample. No published method of analysis for these compounds met these criteria.

Wallin (*4*) has reported that methylene blue combines quantitatively with sodium pentachlorophenate at a pH of 10.9 to form a blue-colored complex which is soluble in chloroform. However, he found that the use of this property as a basis for a colorimetric determination was complicated by a magenta-colored blank obtained when the alkaline methylene blue solution was extracted with chloroform. He describes a method of converting this magenta color to a blue color by filtration of the chloroform layer through cotton. This blank could then be used to correct unknowns treated in the same way by using a spectrophotometer and setting the instrument to zero with the blank.

Preliminary tests indicated that this method was sufficiently sensitive to meet the desired requirements provided it could be simplified by doing away with the spectrophotometer and substituting color standards to read the tests. The chief source of difficulty was the

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magenta-colored blank which completely obscured the blue of the complex in the low concentration range. Further experimentation showed that the interference could be eliminated by mixing equal proportions of an aqueous solution of methylene blue chloride and saturated sodium bicarbonate solution and extracting the mixture with chloroform until the magenta color was removed. The resulting bicarbonate-methylene blue solution could then be used as a reagent for the test for periods up to 1 week without interference from extracted color. The pH of the reagent is approximately 8.5. This was found to be sufficiently alkaline for the quantitative formation of the methylene blue pentachlorophenate complex without further adjustment, thus eliminating the need for any additional buffers in carrying out the test.

Reagents Required

Methylene blue chloride solution. A 0.02 percent solution of methylene blue chloride is prepared from certified dye (CI 922). The weight of material taken for the preparation of the solution is corrected for the dye content of the dye lot as stated on the label. Thus, for the preparation of 250 ml. of this solution from dye labeled as 88 percent actual dye content, 0.0568 gm. of the dye is weighed out, dissolved in approximately 200 ml. of water,[1] and diluted to 250 ml. in a volumetric flask. The solution is stored in a tightly closed brown bottle and protected from direct sunlight. Under these conditions it has shown no apparent deterioration for periods up to 1 month.

Bicarbonate-methylene blue reagent. A 25-ml. volume of the 0.02 percent methylene blue solution is mixed with 25 ml. of saturated sodium bicarbonate solution in a 100-ml. separatory funnel. The mixture is extracted with successive 25-ml. portions of chloroform until the chloroform extract is colorless, or nearly so. Usually four or five extractions are sufficient.[2] The aqueous phase is stored in a tightly closed bottle with a minimum of exposure to strong light. It remains usable for about 1 week, or until 1 ml. of it, diluted to 5 ml. with water and shaken for 15 seconds with 5 ml. of chloroform in a 16 by 150 mm. test tube, develops an appreciable pink color in the chloroform layer within a 15-minute period.

Chloroform. The chloroform should be of USP grade.

Sodium bicarbonate. A saturated solution of CP or ACS grade of sodium bicarbonate is prepared by shaking 15 to 20 gm. of the salt with 100 ml. of water.

Sodium citrate. CP or reagent grade crystals are used.

[1] The water used for the preparation of the reagents should preferably be distilled or deionized. Tap water may be used with more or less loss of stability.

[2] The chloroform used for the extractions may be recovered by shaking it with an equal volume of 0.1 *N* hydrochloric acid, followed by washing twice with an equal volume of water. The recovered chloroform is suitable for further use in the preparation of the reagent but should not be used in the test procedure.

Color Standards

The color standards used for the determination are prepared by making suitable dilutions of the 0.02 percent methylene blue chloride solution. The values for these dilutions were determined by matching the colors produced by known concentrations of pure sodium pentachlorophenate in the test procedure with the proper dilution of the dye solution. If the diluent is water, the life of the standards is short as judged by fading and the deposition of insoluble material. The life of the standards may be increased to 2 or 3 weeks if 0.1 *N* hydrochloric acid is used as the diluent. The dilution factors for the preparation of the color standards follow:

Ppm. (5-ml. sample)	2	5	10	25	50	100
Dilute 1 ml. of 0.02 percent methylene blue solution to ml.	60	30	20	10	5	3

The ppm. figures are based on the use of a 5-ml. sample for the test. Approximately 10 ml. of each standard is placed in a clean screw-capped 16 by 150 mm. culture tube [3] and protected from strong light when not in use. The same standards may be used for the determination of copper pentachlorophenate solutions since the pentachlorophenol content differs from the sodium salt by only approximately 3 percent, which is not detectable by this method.

Reproducibility of the color standards. In order to test the reproducibility of the color standards with varying sources of methylene blue chloride, five different lots of the certified dye were obtained from various suppliers. The stock 0.02-percent solution of each was prepared as described and dilutions were made for the prescribed standards. When inspected in the 16-mm. tubes, agreement among the different lots was excellent. The bicarbonate-methylene blue reagent was also prepared from each dye sample and tests were made at 2 and 10 ppm. on sodium pentachlorophenate. The colors produced in the tests matched very well with the corresponding color standards. Thus, it may be concluded that no great variation in results may be expected with different lots of certified dye.

Procedure

Place 5 ml. of the water to be tested in a 16 by 150 mm. screw-capped culture tube; add 1 ml. of the bicarbonate-methylene blue reagent and 5 ml. of chloroform. Close the tube tightly and shake it vigorously for 15 seconds. Place the tube upright and as soon as separation of the layers is complete inspect the upper layer. If it is

[3] These tubes as supplied by the Kimble Glass Co. have a coated paper liner over a cork backing in the cap. This coating is soluble in chloroform and should be removed and replaced by an aluminum foil disc in the tubes used for the test. The coated paper liners should be retained for the tubes used for the color standards which are prepared with hydrochloric acid.

definitely blue, the sample contains 10 ppm. or less of pentachlorophenate, and the color in the lower layer is compared [4] with the standards to obtain the concentration. For concentrations greater than 10 ppm. the upper layer in the test tube will be colorless, or a very pale blue after it is shaken with 1 ml. of reagent. In this case, add 1 ml. more of the reagent and shake the tube as before. This is repeated until a definite blue color is produced in the upper layer. The color of the lower layer is then compared with the standards to estimate the concentration. In general, it will require an additional 1 ml. of reagent for samples containing 25 ppm., 2 ml. for 50 ppm., and 4 ml. for 100 ppm. before a definite blue color is observed in the upper phase. After the extraction of the color into the chloroform layer, the tests should be read as soon as the chloroform layer is clear (3 to 5 minutes) and in any case within 30 minutes. This limit is necessary since a pink color which develops in time in the chloroform layer makes comparison with the standards especially difficult in the range of 1 to 5 ppm. It is advisable to run a blank determination on 5 ml. of the water from the stream before treatment with the pentachlorophenate in order to eliminate the possibility of interfering substances. A blank is also useful in estimating concentrations approximating 1 ppm. in which the color will be lighter than the 2 ppm. standard but definitely bluer than the blank. The practical accuracy of the method is about 20-percent error in the range of 5 to 100 ppm. and ± 1 ppm. below 5 ppm.

Reproducibility of the test. The sodium and copper pentachlorophenates used as molluscacides are technical grade chemicals and are subject to variation in pentachlorophenol content and the kind and amount of impurities present. It seemed probable that different lots of the chemicals might give varying results on observed values for the concentration of solutions prepared from them on a purely weight basis. Samples of commercial sodium pentachlorophenate, Dowicide G (Dow Chemical Co.), Santobrite Pellets, and Santobrite Briquettes (Monsanto Chemical Co.), were obtained and solutions of known concentration by weight were prepared from them. Upon analysis of these solutions by the test procedure, it was found that no visible difference in the intensity of the color for comparable concentrations was produced among the various samples and that they also matched the proper color standards. The color standards were originally standardized against known concentrations of sodium pentachlorophenate prepared from purified pentachlorophenol. This result seemed remarkable considering that the technical samples were

[4] Comparison of the color of the chloroform layer in the tubes with the color standards is greatly facilitated by the use of a simple wooden comparator block having three holes into which the tubes can be slipped. Transverse slots are cut through the block near the bottom so that only the chloroform layer is visible when the tubes are in place. A piece of ground glass cemented over one end of the slots will provide more even illumination and freedom from troublesome reflections.

labeled as containing from 74 to 79 percent sodium pentachlorophenate, 11 percent other sodium chlorophenates, and 10 to 15 percent inert matter. It was apparent that some of the other chlorophenates must also be forming a chloroform-soluble complex with the methylene blue; otherwise the tests would be noticeably lighter than the standards. The sodium salts of phenol, 2, 4-chlorophenol, 2,4,5- and 2,4,6-trichlorophenol, and 2,3,4,6-tetrachlorophenol were examined for their ability to form the chloroform-soluble complex under the test conditions; only the tetrachloro compound did so. It may then be concluded that technical sodium pentachlorophenate contains sufficient tetrachlorophenate to give results with this test which are comparable to those given by pure sodium pentachlorophenate within the limits of error of the method. It is also noteworthy that the test seems to be specific for the tetra and pentachloro derivatives to the exclusion of the lower chlorinated members.

Only two samples of technical copper pentachlorophenate (Monsanto Chemical Co.) were available for testing. Both gave good matches with each other and with the standards.

Interfering substances. Hard water, water containing considerable amounts of iron or high concentrations of copper pentachlorophenate will produce a cloudy precipitate with the bicarbonate-methylene blue reagent. The precipitate is carried into the chloroform layer as a suspension and makes comparison with the standards difficult. This interference is eliminated by dissolving a few milligrams (four or five small crystals) of sodium citrate in the 5-ml. sample before adding the reagent. This prevents the formation of a precipitate by the alkaline reagent.

Summary

A rapid method of determining sodium and copper pentachlorophenates in concentrations of 1 to 100 ppm. in water is given. The method is intended for use in the field as an aid in investigating the molluscacidal action of these compounds in natural waters and involves the use of a minimum of equipment and reagents.

REFERENCES

(*1*) Nolan, M. O., and Berry, E. G.: Preliminary field trials with laboratory-tested molluscacides. Pub. Health Rep. **64**: 942–949 (1949).

(*2*) Berry, E. G., Nolan, M. O., and Gonzáles, J. Oliver: Field tests of molluscacides against *Australorbis glabratus* in endemic areas of schistosomiasis in Puerto Rico. Pub. Health Rep. **65**: 939–950 (1950).

(*3*) McMullen, D. B., Komiyama, S., Ishii, N., Endo-Itabashi, T., Ozawa, T., and Mitoma, Y.: The use of molluscacides in the control of *Oncomelania nosophora,* an intermediate host of *Schistosoma japonicum.* (In press).

(*4*) Wallin, Guy R.: Colorimetric determination of sodium pentachlorophenate. Analytical Chem. **22**: 1208–1209 (1950).

Evaluation of County-Wide DDT Dusting Operations In Murine Typhus Control, 1950

By Harvey B. Morlan and Virginia D. Hines*

An evaluation of county-wide DDT dusting operations in murine typhus control was started in southwestern Georgia during the fall of 1945. Methods and some of the extensive data have been reported (*1–4*). The present paper reports on a continuation of the study of residual effectiveness of previous DDT dusting operations in murine typhus control and includes observations made in July and August 1950.

Rat runs and harborages in Thomas County and Brooks County were treated with 10 percent DDT dust. Five county-wide dusting cycles were completed from April 1946 to September 1947. Grady County was not treated. As previously reported (*1–4*), dusting operations resulted in satisfactory control of the oriental rat flea, *Xenopsylla cheopis* (Rothschild), and of the mouse flea, *Leptopsylla segnis* (Schönherr), accompanied by a marked reduction in prevalence of typhus complement-fixing antibodies in rats and a decreased incidence of human murine typhus fever.

A monthly trapping quota was set at 10 rats from each of 16 geographically representative trapping stations in each county and 5 rats from each of the areas peripheral to the stations. Although these quotas were not completely filled, sufficient numbers of rats were obtained to give reliable representative comparisons between counties each month.

Surveillance studies of rats and their ectoparasites were discontinued from December 1949 to June 1950. Data comparable to those previously collected were obtained during July and August 1950. The number of rats examined are shown in table 1.

Control of rat ectoparasites was more effective in Brooks County than in Thomas County. Factors that may account for this difference include: (1) The last dusting cycle was 2 months later in Brooks County than in Thomas County. (2) In the five dusting cycles, an average of 4.7 pounds of 10 percent DDT dust was used per treated establishment in Brooks County and only 3.5 pounds per treated establishment in Thomas County. (3) During all dusting operations, the average number of establishments treated was about 87 percent

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Table 1. *Domestic rats examined during 1950*

County	Number rats examined for ectoparasites		Number of rat sera examined	
	July	August	July	August
Grady	219	204	191	179
Thomas	182	221	161	182
Brooks	223	232	175	184

of the total in Brooks County and only about 79 percent in Thomas County.

References to abundance of ectoparasites in the present report are based on the percentages of examined rats which were infested with one or more individual ectoparasites of any given species. Such figures are considered a better guide to the possible epidemiological significance of the species than any other commonly used index.

The percentages of rats infested with *X. cheopis* are shown by months in figure 1. In the absence of additional dusting operations after September 1947, abundance of *X. cheopis* followed a generally downward trend until February 1948. Less than 2 percent of the Brooks County rats were infested with *X. cheopis* during any one of the 8 months, September 1947 to April 1948. In the same period, less than 10 percent of the Thomas County rats were infested in any one month. An upward trend in *X. cheopis* abundance on rats from dusted areas began during March and April 1948 and continued in 1949 and 1950.

Table 2. *Percentage of rats infested with* Xenopsylla cheopis

Month	County	1947	1948	1949	1950
July	Grady (untreated)	61	50	74	77
	Thomas (dusted 1946–47)	3	20	25	31
	Brooks (dusted 1946–47)	5	3	14	23
August	Grady (untreated)	60	64	57	70
	Thomas (dusted 1946–47)	9	18	27	31
	Brooks (dusted 1946–47)	3	4	20	27

Table 2 shows July and August records of *X. cheopis* infestation for the past 4 years. The progressive increase in *X. cheopis* abundance in dusted counties resulted in higher percentages of infested rats in 1950 than at any time since 1946. Infestation was consistently higher in untreated than dusted counties. The percentages of rats infested with *X. cheopis* in July 1950 were 77, 31, and 23 for Grady (untreated), Thomas (dusted) and Brooks (dusted) Counties, respectively; in August 1950 the percentages were 70, 31, and 27.

After discontinuance of dusting operations, abundance of the mouse flea, *Leptopsylla segnis* (Schönherr), followed a downward trend of a degree similar to *X. cheopis*. The peak of seasonal abundance for *L.*

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segnis occurred in early spring as contrasted with a late summer peak for *X. cheopis*. *L. segnis* was suppressed more in dusted areas during the 1948 seasonal peak than during the similar period of 1949. During February the percentage of Grady County rats infested with *L. segnis* was 67, 56, and 67 for 1946, 1947, and 1948, respectively. Similar figures for the same periods were 12, 8, and 18 in Thomas County and 8, 0, and 3 in Brooks County. In July and August 1950, about 9 percent of the rats from Grady County were infested compared to less than 1 percent of the rats from the dusted counties.

Dusting was less effective in control of the tropical rat mite, *Bdellonyssus bacoti* (Hirst) (=*Liponyssus bacoti*). From May 1947 to November 1949, rats from dusted areas were consistently less heavily infested than those from the untreated county. With few exceptions, *B. bacoti* was more abundant on Thomas County than on Brooks County rats during 1948 and 1949. Observations of infestation in November 1949 and July and August 1950 indicate that the DDT dusting operations have lost their residual effectiveness in control of *B. bacoti*. In November 1949, the percentage of rats infested with *B. bacoti* was 14, 20, and 13 in Grady, Thomas, and Brooks Counties, respectively. Figures for the same counties were 22, 8, and 14 in July 1950; 15, 11, and 15 in August 1950.

During 1947 there was a slight reduction in abundance of the common rat louse, *Polyplax spinulosa* (Burmeister), on rats from dusted areas. Infestation of rats with *P. spinulosa* has been about as heavy in Thomas County as Grady County since February 1948 and as heavy in Brooks County as Grady County since May 1948.

The percentages of rat blood sera that were positive to the murine typhus complement fixation test showed a sharp decline following institution of dusting operations in Thomas and Brooks Counties.[1]

The trend (fig. 2) continued downward until January and February of 1948. Less than 2 percent of the Brooks County rats collected were positive during any one of the 6 months, November 1947 to April 1948. Positive rats did not exceed 9 percent of any month's collection from dusted counties during August 1947 to April 1948. From March 1948 to August 1950 there was a generally upward trend in prevalence of positive rats from dusted counties. July and August records for the past 4 years (table 3) show examples from the general trend and current comparisons between treated and untreated counties. The percentages of positive rats in July 1950 were 46, 7, and 6 for Grady, Thomas, and Brooks Counties, respectively; in August 1950 the percentages were 44, 12, and 13.

Determination of the human incidence of murine typhus fever has been a major objective of this study. Case-finding techniques have been employed continuously since the institution of operations.

[1] Both rat and human blood sera were examined by the Communicable Disease Center Serological Laboratory under direction of Dr. Joseph H. Schubert.

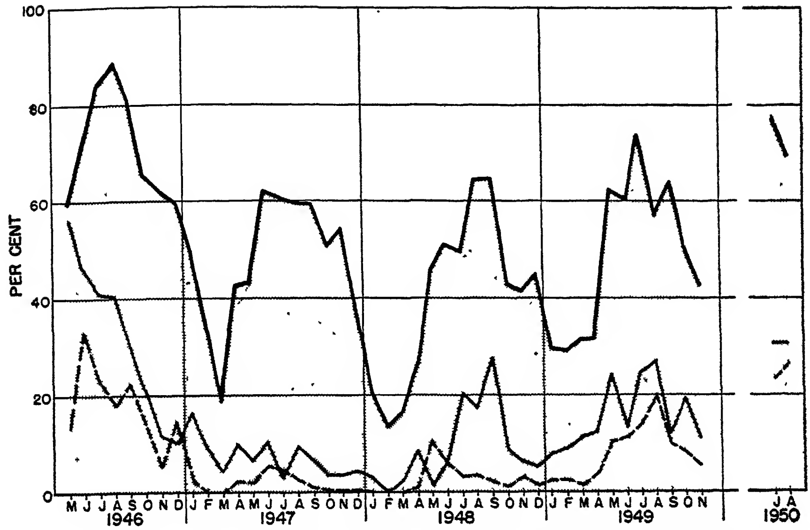

Figure 1. Percentage of domestic rats infested with *Xenopsylla cheopis*.

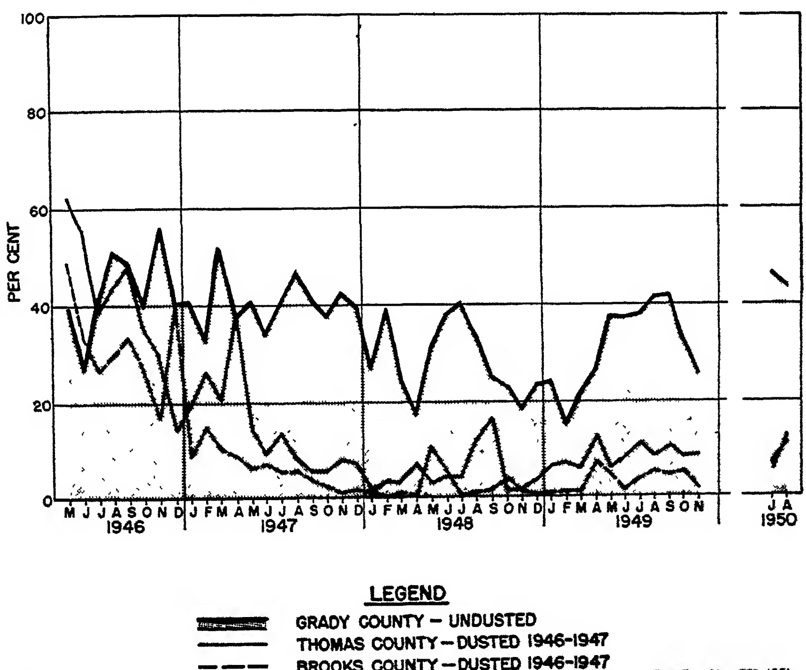

Figure 2. Percentage of domestic rats positive to the murine typhus complement fixation test.

Table 3. *Percentage of rat blood sera positive to the murine typhus complement fixation test*

Month	County	1947	1948	1949	1950
July	Grady (untreated)	40	40	38	46
	Thomas (dusted 1946–47)	14	4	11	7
	Brooks (dusted 1946–47)	6	0	4	6
August	Grady (untreated)	46	34	42	44
	Thomas (dusted 1946–47)	9	12	9	12
	Brooks (dusted 1946–47)	6	1	5	13

These techniques have included frequent contact with physicians, a population census and survey, reports from State and local health departments, hospital records, and records of reputed cases discovered through rumor. The Bengston and Kolmer complement-fixing antibody tests have been employed for confirmation or negation of human cases. The presence of a titer of 1 to 4 or greater and a clinical history compatible with this disease have been arbitrarily determined as the criteria necessary to establish the diagnosis of a case.[2]

As seen in table 4, the morbidity rates of human typhus fever decreased markedly in both dusted counties within the first year of control activities. An appreciable degree of suppression has been maintained to date, although a gradual increase in human disease is suggested in Brooks County.

Table 4. *Morbidity rates of recognized human murine typhus fever in Grady, Thomas, and Brooks Counties, Georgia, from 1945 through September 1950*

Year	Grady (untreated)			Thomas (dusted 1946–47)			Brooks (dusted 1946–47)		
	Cases	Population[1]	Morbidity rate[2]	Cases	Population[1]	Morbidity rate[2]	Cases	Population[1]	Morbidity rate[2]
1945	46	16.8	274.0	69	34.1	202.3	35	16 0	218 8
1946	50	17.3	289 0	36	35.1	102 6	12	16.5	72.7
1947	30	18.5	162.2	7	36.4	19.2	0	18 9	-------
1948	26	18.5	141.0	3	35.5	8.5	2	19.0	10.5
1949	28	18.5	151.4	2	35 2	5.7	2	19.1	10.5
January–September 1950	19	18.9	100.5	0	33 9	-------	2	18.1	11 0

[1] Population in thousands.
[2] Morbidity rate per 100,000.

Summary

Treatment of rat runs and harborages with 10 percent DDT dust produced effective murine typhus control that was maintained without further effort for about 3 years after completing the last dusting cycle.

In areas dusted before September 1947, *X. cheopis* abundance and prevalence of typhus antibodies in rats followed a downward trend until February 1948. From March 1948 to August 1950, the trend was gradually upward.

[2] During 1950, medical consultation was contributed by Dr. Ralph S. Paffenbarger, Jr., S. A. Surgeon, Communicable Disease Center Epidemiologic Services.

Percentages of rats infested with *X. cheopis*, and positive to the typhus complement fixation test during 1950 were:

County	Percent infested— July	Percent infested— August	Percent positive— July	Percent positive— August
Grady (untreated)	77	70	46	44
Thomas (dusted)	31	31	7	12
Brooks (dusted)	23	27	6	13

In both treated counties, morbidity rates of human typhus fever were decreased within the first year of dusting operations, and a significant degree of suppression was maintained.

REFERENCES

(*1*) Hill, Elmer L., and Morlan, Harvey B.: Evaluation of county-wide DDT dusting operations in murine typhus control. Pub. Health Rep. **63**: 1635–1653 (1948).

(*2*) Dent, Jack E., Morlan, Harvey B., and Hill, Elmer L.: Effects of DDT dusting on domestic rats under colony and field conditions. Pub. Health Rep. **64**: 666–671 (1949).

(*3*) Morlan, Harvey B., Hill, Elmer L., and Schubert, Joseph H.: Serological survey for murine typhus infection in southwest Georgia animals. Pub. Health Rep. **65**: 57–63 (1950).

(*4*) Hill, Elmer L., Morlan, Harvey B., Utterback, Bernice C., and Schubert, Joseph H.: Evaluation of county-wide DDT dusting operations in murine typhus control (1946 through 1949). Am. J. Pub. Health **41**: 396–401 (1951).

Five New *Salmonella* Types

Salmonella quiniela [1]

By Calvin L. Stucker,* Mildred M. Galton,* P. R. Edwards,† and Mary A. Fife†

The new type, *Salmonella quiniela*, is represented by only one culture, isolated from a rectal swab taken from an apparently normal greyhound. Upon biochemical examination the organism was found to possess the usual characteristics of the genus *Salmonella*. Hydrogen sulfide was produced and d-tartrate and citrate were utilized, but indol was not formed nor was gelatin liquefied. Glucose, arabinose, xylose, rhamnose, maltose, dulcitol, mannitol, sorbitol, and inositol were fermented within 24 hours with the production of acid and gas. Lactose, sucrose, trehalose, raffinose, adonitol, and salicin were not fermented.

The organism was a member of group C_2 of the genus *Salmonella* and was agglutinated to titer by O serum prepared from *Salmonella newport* (VI, VIII). In absorption tests *S. quiniela* removed all agglutinins from that serum. The O antigens of *S. quiniela* are VI, VIII.

The H antigens of *S. quiniela* were diphasic. Phase 1 was agglutinated by serum derived from phase 1 of *Salmonella cholerae-suis* (c), and, in absorption tests, removed all agglutinins from that serum. Phase 1 of *S. quiniela* may be expressed by the symbol c. Phase 2 of *S. quiniela* was agglutinated by serums prepared from *Salmonella abortus-equi* (e, n, x) and from phase 2 of *Salmonella glostrup* (e, n, z_{15}). It was agglutinated by single factor z_{15} serum but not by single factor x serum. In absorption tests the organism removed all agglutinins from serum derived from phase 2 of *S. glostrup*. Phase 2 of *S. quiniela* is e, n, z_{15}. The antigenic formula of the new type is therefore VI, VIII: c–e, n, z_{15}.

Summary

A new *Salmonella* type, *Salmonella quiniela*, was isolated from the rectal swab taken from an apparently normal greyhound. The antigenic formula of the organism was VI, VIII: c–e, n, z_{15}.

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†Laboratory Services, Communicable Disease Center, Public Health Service, Atlanta, Ga.

[1] This work was supported in part through a grant from the Armed Services Epidemiological Board and in part by the Veterinary Public Health Services, Communicable Disease Center.

Salmonella milwaukee

By P. R. Edwards and Mary A. Fife

Salmonella milwaukee was isolated by Mary Nimlos in the laboratory of the Milwaukee Health Department. Four cultures of the organism were isolated from the stools of as many members of a family which was affected with acute gastroenteritis. The cultures were forwarded to the writers for identification.

The four cultures possessed the usual biochemical characteristics of the genus *Salmonella*. Hydrogen sulfide was produced, d-tartrate and citrate were utilized, but indol was not formed. Gelatin was liquefied very slowly, a slight crater of liquefaction at the surface of the medium becoming visible after 45 days incubation at 25° C. Glucose, arabinose, xylose, rhamnose, maltose, trehalose, mannitol, sorbitol, and dulcitol were fermented promptly with the production of acid and gas. Lactose, sucrose, raffinose, inositol, adonitol, and salicin were not fermented.

The O antigens of *S. milwaukee* were related to those of group G (XIII . . .) of the genus. This relationship is shown in the table. When tested with serums for single factors XXII, XXIII, XXXV, and XXXVI which occur in group G, reactions were obtained in none of them. In addition to their relationship to group G, the organisms were much more closely related to O antigen 21 of the Arizona group.[1] As shown in the table, the O antigens of *S. milwaukee* were not identical with Arizona O 21. Inasmuch as *S. milwaukee* lacks major relationships to the O antigens previously described in the *Salmonella* group, it becomes necessary to assign a new symbol, XLIII, to this type.

O antigens of S. milwaukee

Serums	Antigens				
	S. poona	*S. grumpensis*	*S. worthington*	Arizona O 21	*S. milwaukee*
S. poona: Unabsorbed	1,280	320	320	80	40
S. worthington:					
Unabsorbed	1,280	1,280	2,560	160	160
Absorbed by Arizona O 21	320	640	1,280	<40	40
Arizona O 21:					
Unabsorbed	80	640	640	5,120	2,560
Absorbed by:					
S. worthington	<40	<40	<40	1,280	1,280
S. milwaukee	<40	<40	<40	1,280	<40
S. milwaukee:					
Unabsorbed	40	160	160	2,560	5,120
Absorbed by:					
S. worthington	<40	<40	<40	1,280	2,560
Arizona O 21	<40	80	80	<40	1,280

[1] Edwards, P. R., West, M. G., and Bruner, D. W.: The serologic classification of the Arizona group of paracolon bacteria. J. Infect. Dis. 81: 19–23 (1947).

The H antigens of *S. milwaukee* were monophasic and were agglutinated to the titer of *Salmonella derby* (f, g) serum. They were agglutinated by single factor f serum and in absorption tests completely exhausted the H agglutinins of *S. derby* serum. The H antigens of *S. milwaukee* may be expressed as f, g. The antigenic formula of the organism is XLIII: f, g.

Summary

A new *Salmonella* type, *Salmonella milwaukee,* was represented by four cultures which were isolated from a familial outbreak of gastroenteritis. The cultures possessed a somatic antigen not hitherto found in *Salmonella* cultures. The new type was assigned the antigenic formula XLIII: f, g.

Salmonella homosassa

By P. R. Edwards, and Mary A. Fife

Salmonella homosassa first was isolated in the laboratories of the Florida State Department of Health during a survey of salmonellosis incidence in dogs in Florida. The first culture was isolated from a rectal swab taken from an apparently normal dog and was forwarded to the writers by Mildred M. Galton. Later, Mrs. Galton recognized and forwarded two additional cultures of the same type which also were isolated from dogs.

S. homosassa was a typical representative of the genus *Salmonella.* The organism fermented d-tartrate, utilized citrate, and produced hydrogen sulfide but did not form indol nor liquefy gelatin. Glucose, arabinose, xylose, rhamnose, maltose, trehalose, dulcitol, sorbitol, mannitol, and inositol were fermented promptly with the production of acid and gas. Lactose, sucrose, raffinose, adonitol, and salicin were not attacked.

On serological examination it was found that *S. homosassa* was a member of group H of the Kauffmann-White classification. It was agglutinated to the titer *Salmonella florida* O serum (I, VI, XIV, XXV) and by absorbed XIV and XXV serums. In absorption tests it removed all agglutinins from *S. florida* O serum.

The H antigens of *S. homosassa* were diphasic. Phase 1 was agglutinated to the titer of serum derived from phase 1 of *Salmonella poona* (z), and, in absorption tests, removed all agglutinins from that serum. Phase 1 of *S. homosassa* may be expressed by the symbol z. Phase 2 was agglutinated by serums for the nonspecific antigens of the genus. When tested with single factor serums for antigens 2, 5, 6,

and 7, it was agglutinated only by 5 serum. In absorption tests it reduced the titer of serum for phase 2 of *Salmonella thompson* (1,5) from 1 to 10,000 to 1 to 50. Phase 2 of *S. homosassa* may be expressed as 1,5. Thus the antigenic formula of the organism is I, VI, XIV, XXV: z–1,5.

Summary

A new *Salmonella* type, *Salmonella homosassa,* is represented by three cultures, all of them isolated from rectal swabs taken from apparently normal dogs. The antigenic formula of the organism was I, VI, XIV, XXV: z–1,5.

Salmonella thomasville

By P. R. Edwards, Thelma DeCapito,* and Mary A. Fife

The new type, *Salmonella thomasville,* is represented by only one culture isolated in the laboratories of the Dysentery Vector Control Project at Thomasville, Ga. It was recovered from a rectal swab taken from an asymtomatic dog in the course of routine culturing of animals in a veterinary hospital. *Salmonella tennessee* also was isolated from the same specimen.

On preliminary examination *S. thomasville* was found to possess the usual morphological and biochemical characteristics of the *Salmonella* group. The organism produced hydrogen sulfide and utilized d-tartrate and citrate, but did not produce indol. Gelatin was liquefied after 45 days at 25° C. Glucose, xylose, arabinose, maltose, trehalose, rhamnose, dulcitol, sorbitol, mannitol, and inositol were fermented promptly with the production of acid and gas. Lactose, sucrose, raffinose, salicin, and adonitol were not attacked.

The organism was a member of group E of the Kauffmann-White classification and upon closer examination the somatic antigens were found to be (III), (XV), XXXIV. The organism was agglutinated to the titer of *Salmonella illinois* O serum [(III), (XV), XXXIV] and in absorption tests removed all agglutinins from that serum. As noted by Bruner and Moran,[1] organisms which had the above mentioned antigens possessed a somatic relationship to *Salmonella onderstepoort* (I, VI, XIV, XXV) which is not expressed in the antigenic formula. They are actively agglutinated by I, VI, XIV XXV serum and by absorbed single factor XIV serum.

In the examination of the H antigens, it was found that *S. thomasville* was diphasic. Phase 1 was agglutinated to the titer of, and in absorp-

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[1] Bruner, D. W., and Moran, A. B.: *Salmonella canoga*—a new type. J. Bact. 57: 135–136 (1949).

tion tests removed all agglutinins from, serum derived from phase 1 of *Salmonella madelia*. Phase 1 of *S. thomasville* may be expressed by the symbol y. Phase 2 of *S. thomasville* was agglutinated by 1,2; 1,5; 1,6; and 1,7 serums. When tested with single factor serums for 2, 5, 6, and 7, it was agglutinated only by 5 serum. It was agglutinated to the titer of serum derived from phase 2 of *Salmonella thompson* and in absorption tests reduced the titer of the serum for the homologous organism from 1 to 10,000 to 1 to 200. Phase 2 of *S. thomasville* may be expressed as 1,5. Thus, the antigenic formula for the organism is (III), (XV), XXXIV: y–1,5.

The collaboration of Dr. H. G. Young, veterinarian, in providing animals for study in the Dysentery Vector Control Project is gratefully acknowledged.

Summary

A new *Salmonella* type, *Salmonella thomasville,* was isolated from a rectal swab taken from an asymptomatic dog. The organism was represented by the antigenic formula (III), (XV), XXXIV: y–1,5.

Salmonella albany

By Mary G. West,* and P. R. Edwards

Salmonella albany was isolated from the stool of an apparently normal food handler by Marjorie Standifer in the Albany, Ga., laboratory of the Georgia State Department of Health. It was forwarded to the writers by Janie F. Morris, who recognized the organism as an unusual or undescribed *Salmonella* type.

S. albany possessed the usual characteristics of the *Salmonella* group. The organism produced hydrogen sulfide, utilized d-tartrate and citrate, but did not produce indol nor liquefy gelatin. Acid and gas were produced from glucose, arabinose, xylose, rhamnose, maltose, trehalose, sorbitol, mannitol, dulcitol, and inositol within 24 hours. Lactose, sucrose, raffinose, adonitol, and salicin were not fermented.

Serological examination of the organism revealed that *S. albany* was a member of group C_2 of the genus. The organism was agglutinated actively by VI, VIII and VIII, XX serums. Its failure to agglutinate with VI, VII serum indicated that it did not contain antigen VI. It reacted with single factor XX serum and removed all agglutinins from O serum prepared from *Salmonella kentucky* (VIII, XX). The O antigens of *S. albany* are VIII, XX.

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The H antigens of *S. albany* were monophasic and H agglutination occurred only with serums for antigens z_4, z_{23}; z_4, z_{24}; and z_4, z_{32}. When tested with single factor z_{23}, z_{24}, and z_{32} serums, the culture was agglutinated only in z_{24} serum. In absorption tests *S. albany* removed all agglutinins from H serum derived from *Salmonella düsseldorf* (z_4, z_{24}). The antigenic formula of *S. albany* is VIII, XX: z_4, z_{24}.

Summary

A new *Salmonella* type, *Salmonella albany*, was isolated from the stool of an apparently normal food handler. The organism is represented by the antigenic formula VIII, XX: z_4, z_{24}.

Effect of Topically Applied Zinc Chloride and Potassium Ferrocyanide on Dental Caries Experience

By Robert W. Anderson, D.D.S., and John W. Knutson, D.D.S., Dr. P.H.*

On the premise that dental caries is essentially a proteolytic process, Gottlieb evolved several chemical procedures designed to make the tooth substance impervious to invasion by proteolytic bacteria (*1*). The first of these chemical procedures was based on the use of silver nitrate as the protein coagulant (*1,2*). The last involved the use of zinc chloride and potassium ferrocyanide for impregnation of the organic structures of the enamel (*3*).

A series of preliminary reports of the clinical results following the application of Gottlieb's impregnation techniques indicated that the incidence of dental caries was reduced 80 to 90 percent (*1,4,5,6,7,8,9*). On the other hand, the results of laboratory tests of the effect of zinc chloride and potassium ferrocyanide on proteolysis and of two well-controlled clinical studies just recently reported were negative (*10, 11,12*).

The study reported here was made to determine the caries preventive worth of zinc chloride and potassium ferrocyanide applied topically to the teeth of children according to Gottlieb's technique. Briefly, the results indicate that the caries experience in treated teeth during the year following treatment was very similar to that observed in untreated control teeth.

Material and Methods

In April and May 1949, zinc chloride and potassium ferrocyanide were topically applied to the teeth in half the mouth of each of 299 elementary grade school children of Chattanooga, Tenn. The children ranged in age from 7 to 15 years. Approximately half of the children received the application to the teeth in the left side of the mouth; the others were treated on the right side. Teeth in the untreated mouth quadrants served as controls. Before treatment was given, a dental examination of each child was made with mouth mirror and explorer under artificial light and with compressed air available for the examiner's use. The applications were made according to the technique of Gottlieb as follows: (1) The teeth are thorough-

*From the Division of Dental Public Health, Bureau of State Services, Public Health Service. This study was made with the cooperation and assistance of the Tennessee Department of Public Health, and the Chattanooga City County Health Department.

ly cleansed using flower of pumice paste, rubber cups, and dental floss. (2) The teeth are carefully isolated with cotton rolls and thoroughly dried with compressed air. (3) Benzine is applied to the crown surfaces of the teeth and dried with compressed air. (4) A 40-percent solution of zinc chloride is applied to the teeth for 1 minute. (5) A 20-percent solution of potassium ferrocyanide is applied to the teeth and rubbed onto the tooth surfaces until a milky white precipitate forms. (6) A 10-percent aqueous solution of silver nitrate is applied to posterior teeth only.

All solutions were applied with cotton pellets, and linen tape was used on interproximal surfaces. The zinc chloride and potassium ferrocyanide solution contained a wetting agent (polyoxyalkylene sorbitan monolaurate, 1 percent). A maximum of four teeth were isolated and treated at a time, and the procedure was repeated until all the teeth in half the mouth had been treated.

In May 1950, approximately 1 year after treatment, the teeth of children in the study group were reexamined. In making the reexaminations, the examiner did not know whether the teeth in the right or the left half of the mouth had been treated. Only 190 children were available for reexamination; those not reexamined had moved, were absent from school at the time the examinations were made, or had discontinued school attendance. The age distribution of the children initially examined and treated and of those reexamined 1 year later is given in table 1. Age classification refers to age at time of initial examination.

Table 1. *Age distribution of Chattanooga school children initially examined and reexamined at end of study*

Examined	All ages	6	7	8	9	10	11	12	13	14	15
Initial 1949	299	1	35	38	35	35	34	35	30	43	13
Second 1950	190	1	22	28	25	29	28	17	18	18	4

Findings

The caries incidence during the study year in treated and untreated permanent teeth, by upper and lower mouth quadrants is presented in table 2.

In the upper mouth the same number of teeth, 108, were initially attacked by caries in the treated and untreated quadrants. This result is in accord with the bilaterally equal occurrence of caries experience which would normally be expected for the group. The slight difference in the caries incidence rates, calculated on the basis of the number of sound teeth exposed to the risk of attack, is clearly insignificant, 20.0 and 21.1 percent, respectively.

Table 2. *Dental caries experience during a 1-year study period in zinc chloride and potassium ferrocyanide treated and in untreated permanent teeth of 190 Chattanooga children*

Status	Noncarious teeth, April 1949	New DF teeth, May 1950	DF surfaces in new DF teeth	Percent teeth carious
Upper				
Treated	540	108	118	20.0
Untreated	513	108	121	21.1
Lower				
Treated	592	71	88	12.0
Untreated	604	80	88	13.2
Both jaws				
Treated	1,132	179	206	15.8
Untreated	1,117	188	209	16.8

In the lower mouth quadrants, 71 treated and 80 untreated teeth became carious. The percentage attack rates were 12.0 and 13.2, respectively. These differences, based on number of teeth attacked and on percent attack rates, are well within the range of normal sampling variation.

Comparison of the other data presented in table 2, such as the combined caries experience in the teeth of both jaws and in tooth surfaces for treated and untreated categories, reveals no appreciable differences. The conclusion is that under the conditions of this experiment the topical application of zinc chloride and potassium ferrocyanide to the teeth of children, according to the technique of Gottlieb, did not significantly reduce the vulnerability of the teeth to caries attack.

REFERENCES

(*1*) Gottlieb, Bernhard: Dental Caries, Its Etiology, Pathology, Clinical Aspects and Prophylaxis. Philadelphia, Lea & Febiger, 1947.

(*2*) Gottlieb, Bernhard: Caries prophylaxis. Texas Dent. J. **65:** 8–10 (1947).

(*3*) Gottlieb, Bernhard: Technique of impregnation for caries prophylaxis. Texas Dent. J. **66:** 20–23 (1948).

(*4*) Crawford, H. M.: Clinical results of impregnation. Texas Dent. J. **67:** 52–55 (1949).

(*5*) Younger, Harold B.: Clinical results of caries prophylaxis by impregnation. Texas Dent. J. **67:** 96–98 (1949).

(*6*) Gillard, H. F., Boelsche, R. A., and Summers, F. G.: Clinical report on caries control. Houston Dist. Dent. Soc. J. **21:** 2–3 (March 1949).

(*7*) Kalmans, A., and Burgess, B. E.: A report of caries control. Houston Dist. Dent. Soc. J. **21:** 2–3 (April 1949).

(*8*) Toller, J. R.: Report on caries control. Brit. Dent. J. **88:** 172–175 (1950).

(*9*) Agnew, R. Gordon: Impregnation of tooth surfaces with zinc chloride and potassium ferrocyanide. Calif. State Dent. Assoc. J. **26:** 228–232 (1950).

(*10*) Dannenberg, James L., and Bibby, B. G.: Effect of zinc chloride and potassium ferrocyanide on proteolysis. J. Dent. Res. **29:** 177–181 (1950).

(*11*) Ast, David B., Bushel, Arthur, and Chase, Helen C.: A clinical study of caries prophylaxis with zinc chloride and potassium ferrocyanide. Am. Dent. Assoc. J. **41:** 437–442 (1950).

(*12*) Pelton, Walter J.: The effect of zinc chloride and potassium ferrocyanide as a caries prophylaxis. J. Dent. Res. **29:** 756–759 (1950).

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended July 28, 1951

Poliomyelitis

An increase of nearly 25 percent in the number (990) of cases of poliomyelitis was reported in the United States for the current week compared with the previous week (795). The number also exceeds that for the same week last year. Two regions, the New England and the Middle Atlantic, remained stationary. There was an increase of about 60 percent in the West North Central States as compared with the previous week. An increase from 6 to 20 cases in Minnesota and from 9 to 24 cases in Kansas accounted for the rise in this area. Other individual States showing relatively large percentage increases from the previous week were North Carolina, Tennessee, Oklahoma, Texas, Colorado, and California. Louisiana reported a decrease of 25 percent from the previous week.

The cumulative total of cases for the calendar year is now 5,643 compared with 6,113 for the same period last year. The cumulative total since the seasonal low week is 4,431 compared with 4,982 in 1950.

In Louisiana, 64 percent of all cases reported in the 8-week period ended July 21 occurred in a group of 7 parishes located in the extreme northwestern part of the State. Caddo and Red River Parishes reported 61 and 14 cases, respectively, in this period.

In Texas, the number of new cases reported in Nueces County was 15 for the week ended July 7, 12 for the following week, and 10 for the week ended July 21. In San Patricio County, the largest number reported, 9 cases, was for the week ended July 14, but none were reported for the following week.

In Mississippi, where incidence increased from 16 cases for the week ended July 14 to 42 for the following week, the greatest concentration occurred in Sunflower County. Beginning with the week ended June 30, 1 case was reported with 4, 3, and 14 cases, respectively, for the following 3 weeks.

In Colorado, incidence has been increasing in Denver and the surrounding area and in Pueblo.

Epidemiological Reports

Infectious Encephalitis

According to information received from Dr. A. S. McCown, Virginia Department of Health, several cases of infectious encephalitis, five of which were fatal, were reported in Richmond and nearby counties. An investigation being carried on by State and local officials and a representative of the Communicable Disease Center in Atlanta, Ga., is still incomplete, but it reveals that three of the fatal cases, in which the clinical and pathological diagnosis was reasonably certain, resided in Richmond, and the others came from rural areas. The ages of the cases varied from 10 to 23 years. The investigators stress the fact that up to the present time the diagnosis has been based on clinical and pathological findings only, but blood and specimens of brain tissue have been obtained for laboratory examination. Although the cases resemble eastern equine encephalomyelitis infections, no epizootic in animals has been reported in the Richmond area in recent weeks.

Malaria

Dr. A. M. Washburn, Arkansas State Board of Health, states that 79 cases of malaria, all of them confirmed by blood smear, were reported between May 15 and July 22. All were *Plasmodium vivax* infections, and were in military personnel who had returned from Korea. Their ages ranged from 17 to 45 years. Many had been

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	July 28, 1951	July 29, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	------	------	------	(1)	(1)	(1)	(1)	42	27	31
Diphtheria (055)	42	53	113	27th	[2] 119	176	307	[2] 2,127	3,304	4,919
Encephalitis, acute infectious (082)	34	31	12	(1)	(1)	(1)	(1)	540	452	311
Influenza (480–483)	242	201	281	30th	130,597	149,348	149,348	116,055	138,764	128,601
Measles (085)	3,727	2,502	2,502	35th	488,138	301,584	578,358	459,437	282,454	543,412
Meningitis, meningococcal (057.0)	56	50	51	37th	3,660	3,413	3,299	2,699	2,500	2,327
Pneumonia (490–493)	443	697	(3)	(1)	(1)	(1)	(1)	44,539	58,469	(3)
Poliomyelitis, acute (080)	990	969	969	11th	[2] 4,431	4,982	4,982	[2] 5,643	6,113	5,793
Rocky Mountain spotted fever (104)	23	41	41	(1)	(1)	(1)	(1)	198	277	302
Scarlet fever (050) [4]	324	279	394	32d	68,425	56,095	79,724	52,734	39,656	57,180
Smallpox (084)	------	------	------	35th	17	43	68	9	23	47
Tularemia (059)	16	28	25	(1)	(1)	(1)	(1)	406	596	599
Typhoid and paratyphoid fever (040, 041) [5]	89	104	123	11th	976	1,290	1,378	1,411	1,800	1,851
Whooping cough (056)	1,262	2,630	2,428	39th	65,790	100,736	85,841	44,188	79,200	57,712

[1] Not computed. [2] Deductions—North Carolina, week ended June 30: Diphtheria and poliomyelitis, 1 case each. [3] Data not available. [4] Including cases reported as streptococcal sore throat. [5] Including cases reported as salmonellosis.

wounded and had been in the United States for 6 to 9 months before having initial attacks. About one-half of these cases were natives of Arkansas. A large proportion have been on furlough at their homes, some having initial attacks during such time. Only 1 has been detached from military service.

Psittacosis

Dr. D. S. Fleming, Minnesota Department of Health, has reported a case of psittacosis in a 12-year-old boy who had been raising homing pigeons for 2 years. The boy became ill early in May with cough and dyspnea and was hospitalized on May 30. On June 6 a complement fixation test with psittacosis antigen was positive in serum dilution of 1 to 128. Blood specimens from 10 pigeons in the suspected loft were obtained on June 27. Eight of the specimens showed complement fixation titers of 1 to 8 or higher. Material from 7 of the pigeons was sent to the Communicable Disease Center Laboratory in Montgomery, Ala., where a psittacosis virus was reported in a specimen from 1 pigeon.

Rabies in Animals

The Veterinary Public Health Section, Iowa Department of Health, states that rabies in animals was reported in 65 of the 99 counties of the State during the first 6 months of 1951. A total of 299 cases was reported in 10 different species of animals: 126 in dogs, 64 in skunks, 65 in cattle, 13 in swine, 12 in cats, 7 each in foxes and raccoons, 2 each in squirrels and sheep, and 1 in a horse.

Epidemic Conjunctivitis

Dr. J. R. Enright, Hawaii Board of Health, has reported an outbreak of acute conjunctivitis in which three-fourths of the cases were in preschool and school children. It became apparent in February that an increase in conjunctivitis was occurring. Inquiry of physicians revealed the following monthly totals of patients seen from January through June: 109, 310, 434, 544, 468, and 93. A study of school absences indicated a total of about 3,000 cases in school children. An estimated total of 5,000 to 6,000 is considered to have occurred on all of the islands. Symptoms lasted from 3 to 12 days and some relapses were observed. No bacterial or viral agent was recovered, but a virus was suspected as the etiological agent. Response to antibiotic therapy was good. There appeared to be a primary spread by droplet infection in the schools with further family spread at home.

Infectious Hepatitis

Dr. Milton Tully, New York State Health Department, reported an outbreak of infectious hepatitis in rural Chemung County. Twenty cases occurred from January 11 to July 8, half of them in June.

Cases were found principally in school children and were linked by personal contact. Family contact appeared to be more important than school contact.

Plague Infection in Lincoln County, Washington

Dr. V. B. Link, Western Communicable Disease Center Laboratory, reported that the following specimens obtained in Lincoln County were proved positive for plague: (1) Specimen No. 51–WB–26, consisting of 39 fleas (*Megabothris clantoni clantoni*) taken from 43 sage brush voles (*Lagurus curtatus*) which were trapped July 5, 1951, 12 miles southeast of Wilbur (9.6 miles south on State Highway 4B and then 5 miles east on county road); and (2) Specimen No. 51–WB–27, consisting of 137 fleas (61 *Thrassis gladiolis johnsoni* and 76 *M. clantoni clantoni*) taken from 38 *L. curtatus*, trapped July 7, 1951, 17 miles north of Odessa, on State Highway 4B.

Reported Cases of Selected Communicable Diseases: United States, Week Ended July 28, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**42**	**34**	**242**	**3,727**	**56**	**443**	**990**
New England	**1**			**297**		**15**	**32**
Maine				43			2
New Hampshire				9			1
Vermont				33			1
Massachusetts				168			22
Rhode Island	1			17		1	
Connecticut				27		14	6
Middle Atlantic	**4**	**6**		**988**	**11**	**54**	**76**
New York	3	5	(1)	523	5		50
New Jersey		1		292	2	22	9
Pennsylvania	1			173	4	32	17
East North Central	**8**	**6**	**25**	**993**	**9**	**66**	**188**
Ohio	3			277	3		31
Indiana	3	2	21	40		2	6
Illinois	1	2	1	220	4	24	58
Michigan		1	3	87	1	40	58
Wisconsin	1	1		369	1		35
West North Central	**2**	**3**		**141**	**5**	**35**	**80**
Minnesota	1	1		14		1	20
Iowa				12	1	2	13
Missouri				37	1	1	9
North Dakota				27		25	4
South Dakota		2		8	1		2
Nebraska	1			3			8
Kansas				40	2	6	24
South Atlantic	**9**	**4**	**83**	**345**	**10**	**52**	**97**
Delaware				6			3
Maryland	1	1		140	1	3	2
District of Columbia				16		14	5
Virginia	1		74	71	2	23	5
West Virginia	1			6	2		3
North Carolina	3			14	1		15
South Carolina	2		8	1		6	8
Georgia	1		1	36		6	42
Florida		3		55	4		14
East South Central	**5**	**2**	**2**	**65**	**11**	**23**	**119**
Kentucky				21		4	7
Tennessee	2	2		18	6		44
Alabama	3			21	5	2	41
Mississippi			2	5		17	27
West South Central	**8**	**1**	**64**	**171**	**2**	**142**	**182**
Arkansas	1		46	11		15	22
Louisiana				2		16	31
Oklahoma			18	9	1	22	38
Texas	7	1		149	1	89	91
Mountain	**2**	**4**	**52**	**235**	**1**	**16**	**99**
Montana		1	11	64			
Idaho				26			3
Wyoming	1			41			4
Colorado	1		14	8		11	62
New Mexico				12			2
Arizona		3	27	41		5	7
Utah				43	1		13
Nevada							8
Pacific	**3**	**8**	**16**	**492**	**7**	**40**	**117**
Washington	1			30	1	1	9
Oregon		1	10	80		1	7
California	2	7	6	382	6	38	101
Alaska							
Hawaii				40		2	1

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended July 28, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	23	324	-	16	89	1,262	128
New England	-	19	-	1	6	45	-
Maine	-	-	-	-	1	4	-
New Hampshire	-	3	-	-	-	5	-
Vermont	-	-	-	-	-	-	-
Massachusetts	-	13	-	-	3	32	-
Rhode Island	-	-	-	-	2	-	-
Connecticut	-	3	-	1	-	4	-
Middle Atlantic	-	72	-	-	10	152	10
New York	-	44	-	-	1	60	5
New Jersey	-	8	-	-	1	59	-
Pennsylvania	-	20	-	-	8	33	5
East North Central	-	72	-	-	4	209	17
Ohio	-	11	-	-	1	65	1
Indiana	-	3	-	-	2	6	11
Illinois	-	7	-	-	1	26	1
Michigan	-	37	-	-	-	63	3
Wisconsin	-	14	-	-	-	49	1
West North Central	-	18	-	4	3	64	33
Minnesota	-	2	-	4	-	2	12
Iowa	-	2	-	-	1	19	9
Missouri	-	4	-	-	2	16	8
North Dakota	-	6	-	-	-	2	-
South Dakota	-	2	-	-	-	1	-
Nebraska	-	-	-	-	-	1	4
Kansas	-	2	-	-	-	23	-
South Atlantic	18	24	-	2	5	201	18
Delaware	-	-	-	-	-	9	-
Maryland	5	5	-	-	-	5	-
District of Columbia	-	2	-	-	-	4	-
Virginia	4	4	-	1	-	30	5
West Virginia	-	1	-	-	2	49	-
North Carolina	9	7	-	-	1	70	-
South Carolina	-	-	-	-	1	1	5
Georgia	-	-	-	1	1	8	8
Florida	-	5	-	-	-	25	-
East South Central	2	22	-	-	24	135	22
Kentucky	-	7	-	-	8	47	6
Tennessee	2	13	-	-	10	55	6
Alabama	-	2	-	-	4	10	6
Mississippi	-	-	-	-	2	23	4
West South Central	2	10	-	8	17	310	28
Arkansas	1	1	-	5	3	21	5
Louisiana	-	-	-	-	2	4	-
Oklahoma	1	5	-	2	3	63	2
Texas	-	4	-	1	9	222	21
Mountain	1	9	-	1	11	54	-
Montana	-	2	-	-	-	5	-
Idaho	-	-	-	-	3	2	-
Wyoming	-	-	-	1	-	1	-
Colorado	1	1	-	-	2	13	-
New Mexico	-	-	-	-	4	6	-
Arizona	-	3	-	-	2	23	-
Utah	-	3	-	-	-	4	-
Nevada	-	-	-	-	-	-	-
Pacific	-	78	-	-	9	92	-
Washington	-	4	-	-	-	11	-
Oregon	-	7	-	-	-	3	-
California	-	67	-	-	9	78	-
Alaska	-	-	-	-	-	1	-
Hawaii	-	2	-	-	-	-	-

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended July 14, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	2					2					
Chickenpox	595	3		33		70	322	20	20	83	44
Diphtheria	7					7					
Dysentery, bacillary	1										1
German measles	135	1		4		12	61	3	5	23	26
Influenza	28			15				6			7
Measles	793	17		57	24	170	126	42	6	220	131
Meningitis, meningococcal	7	1					2	4			
Mumps	202	12		9		21	89	5	8	32	26
Poliomyelitis	27			4	1		16		1	1	4
Scarlet fever	113					35	13	16	11	13	25
Tuberculosis (all forms)	216	8		2	45	75	25	28	14	19	
Typhoid and paratyphoid fever	12					9	1	1		1	
Venereal diseases:											
Gonorrhea	310	11		9	3	79	39	47	40	32	50
Syphilis	71	4		7	1	23	13	2	10	5	6
Primary	3					1			2		
Secondary	3					2			1		
Other	65	4		7	1	20	13	2	7	5	6
Whooping cough	118	2		7	1	48	29	8	2	9	12

NOTE.—No report received from Canada for week ended July 7, 1951.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently. A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Plague

Burma. During the week ended July 21, 1951, one imported case of plague was reported in Rangoon.

Smallpox

Afghanistan. During June 1951, 74 cases of smallpox were reported.

Cameroon (French). For the period July 1–10, 1951, 6 cases of smallpox were reported as compared with 13 for the previous 10-day period.

French West Africa. Smallpox was reported for the period July 1–10, 1951, as follows: Ivory Coast, 5 cases; Sudan, 28; and Upper Volta, 1.

India. In three ports of India the incidence of smallpox increased during the week ended July 21, 1951. Cases reported were as follows (figures for the previous week are in parentheses): Madras, 40 (21); Calcutta, 15 (9); and Bombay, 5 (4).

Pakistan. One case of smallpox was reported in Chittagong for the week ended July 21, 1951.

Yellow Fever

Colombia. One fatal case of jungle yellow fever was reported on May 28, 1951, in San Vicente de Chucuri, Santander Department.

Panama. A patient from the area of Almirante, near the Costa Rican border, was sent to the hospital on June 9, 1951, as a yellow fever suspect. The protection test was positive for serum drawn on June 12 and 15. A virus was isolated from the serum drawn on June 12. This virus has been tentatively identified as yellow fever. The patient recovered.

+ + +

The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price $4.75 a year. $6.25 foreign

Public Health Reports

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FEDERAL SECURITY AGENCY

PUBLIC HEALTH SERVICE

FEDERAL SECURITY AGENCY
Oscar R. Ewing, Administrator

PUBLIC HEALTH SERVICE
Leonard A. Scheele, Surgeon General

Division of Public Health Methods
G. St. J. Perrott, Chief of Division

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Public Health Reports

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Encephalitis in the Missouri River Basin

II. Studies on a Focal Outbreak of Encephalitis in North Dakota

By H. A. WENNER, M.D., PAUL KAMITSUKA, M. C. KRAMMER, T. A. COCKBURN, M.D., and E. R. PRICE, D.V.M.*

During August 1949, an outbreak of encephalitis occurred in Barnes County, North Dakota.[1] Poliomyelitis was present in the area also, being part of a widespread outbreak in the State during the summer and fall of 1949. Although frank and abortive attacks of poliomyelitis were experienced, a clinically different type of central nervous system illness appeared during the last weeks of July and the first 2 weeks of August. In contrast to poliomyelitis, adults were attacked and experienced illness which was characterized best as encephalitis. This report briefly describes the type of clinical illnesses and some studies made to identify the etiologic agent(s) responsible for illness in patients sick with encephalitis.

Materials and Methods

Poliomyelitis and encephalitis in North Dakota. In the course of the outbreak of poliomyelitis, 451 cases were reported in the State (population 1950, 616,185). During the same period, 126 cases of encephalitis were recorded. The geographical and seasonal distribution of these reported cases appear in figure 1. Inasmuch as it is known that an appraisal of cases which are mild encephalitis and abortive poliomyelitis is difficult, these data must be considered as subject to error.

Poliomyelitis and encephalitis in Barnes County. The geographical distribution of poliomyelitis and encephalitis in Barnes County (population 1950, 16,822) appears in figure 2. Seventeen cases of encephalitis and 14 cases of poliomyelitis were reported. All of these illnesses were reported during the period July 15–August 27. Since a number of patients reported as having poliomyelitis were not paralyzed, some

*From the Histoplasmosis Animal Survey Branch (University of Kansas School of Medicine, Kansas City, Kans.) of the Communicable Disease Center, Atlanta, Ga., and the Hixon Memorial Laboratory, University of Kansas School of Medicine.

[1] We are indebted to Dr. R. O. Saxvik, Executive Officer of the State Board of Health, Bismarck, N. Dak., for the privilege of studying the North Dakota outbreak. Thanks are due also to Kenneth Mosser and Earl Arnold for their assistance.

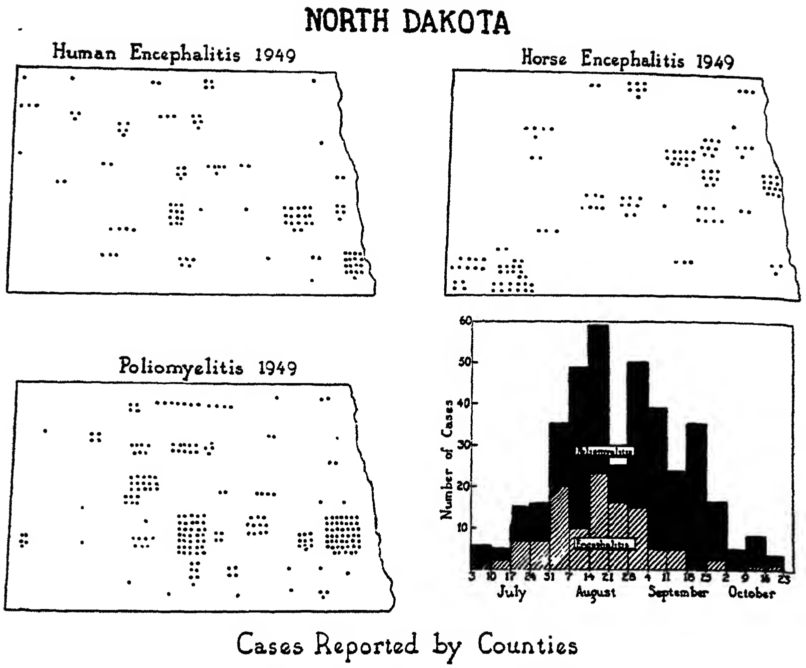

Figure 1. The geographical and seasonal distribution of poliomyelitis and encephalitis in North Dakota in 1949.

probably experienced mild attacks of encephalitis. That the latter possibility is a likely one will appear in adjunct data.

Clinical considerations. Between July 26 and August 15, 1949, 13 recognized human cases of encephalitis were observed in Barnes County. All of the patients were adults; there were 4 females and 9 males. There were three deaths. Necropsies were not performed.

Some data concerning 12 of these patients appear in table 1. One patient died prior to our arrival; information concerning the illness was not obtained. The clinical features of the illnesses were sudden onset with fever (101° to 103° F.), sensations of chilliness, headache, nausea, vomiting, dizziness, and muscular pains, particularly involving the chest. Headache, frontal in distribution, was severe and aggravating. There was stiffness of the neck and back. The spinal fluids had increased cell counts (20 to 300 cells mm.^{3}). These were chiefly lymphocytes.

Specimens collected from human cases. Whole blood, serum, cerebrospinal fluid, oropharyngeal exudate, and feces were obtained from five acutely ill patients. These materials were stored immediately on dry ice and transported to the laboratory. Serums from these five patients and others (see table 1) were obtained in August and October 1949, and in March 1950.

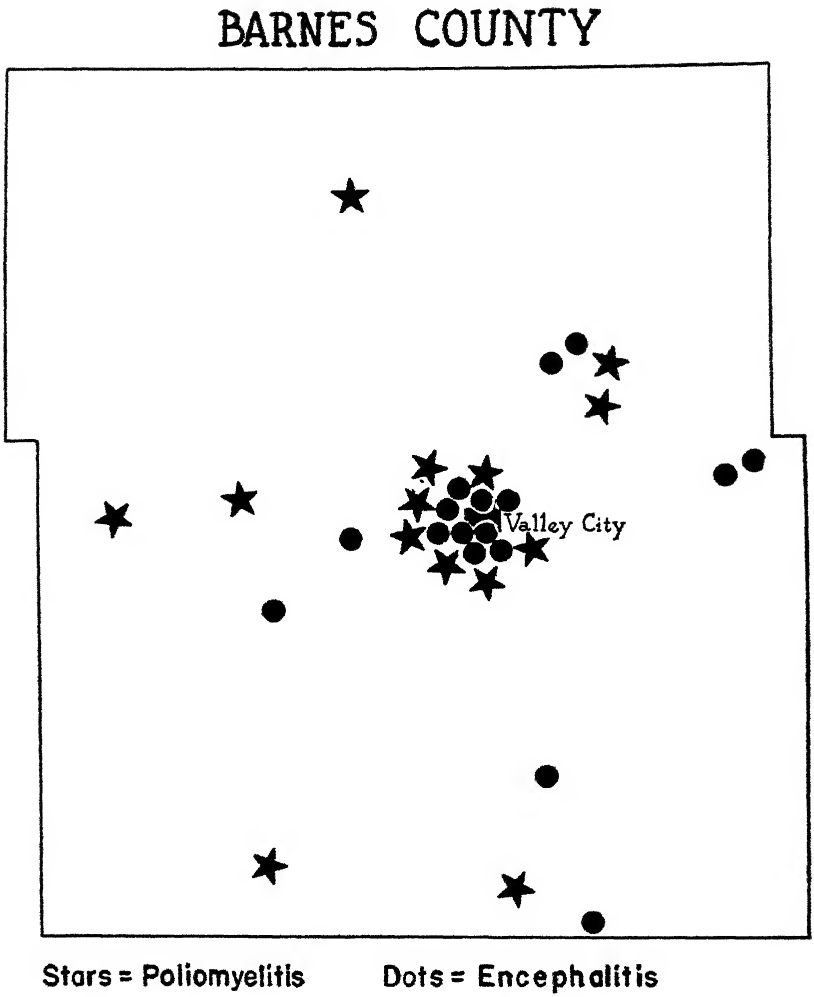

Figure 2. The geographical distribution of poliomyelitis and encephalitis in Barnes County, North Dakota, in 1949.

Specimens collected in the field. A history of an epizootic in domestic animals was not obtained at the time of investigation. Later it was learned that horses in the area and elsewhere in the State (fig. 1) had experienced encephalitis during the summer. Serums were not obtained from horses. Mosquitoes collected August 14 to 15, 1949, in the area of Valley City were as follows:

Aedes vexans	186	*Aedes dorsalis*	68
Aedes triseriatus	2	*Culex tarsalis*	81
Aedes nigromaculis	18	*Culex*, species unidentified	3

Table 1. *Notes on clinical findings and specimens collected from patients with encephalitis*

Patient	Age	Sex	Onset	Symptoms	CSF[1]	Specimens collected: Blood	OP[2]	Stool	Serum 1	Serum 2
B. R.	24	M	8/10/49	Headache, stiff neck	±	8/13	8/13	8/13	8/13	3/25/50
E. C. P.	33	F	7/26/49	Headache, stiff neck	+	8/13	------	8/13	8/13	10/24/49
E. G.	59	M	8/11/49	Fever, headache, backache, stiff neck.	?	8/13	8/13	8/13	8/13	3/25/50
G. K.	64	M	7/30/49	Headache, confusion lethargy, depression.	+	8/13	------	------	8/13	3/25/50
R. S.	20	M	8/13/49	Fever, headache, backache	+	8/14	8/14	8/14	8/14	3/25/50
R. K.	38	M	8/4/49	Fever, chills, diplopia; died 8/10/49.	+	------	------	------	------	-------
T. W.	26	M	8/4/49	Headache, nausea, vomited, stiff neck, backache.	+	------	------	------	8/14	3/25/50
I. L.	27	F	8/1/49	Headache, nausea, stiff back and neck.	+	------	------	------	8/14	10/24/49
R. F.	25	M	8/3/49	Headache, stiff back and neck	+	------	------	------	------	3/25/50
A. K.	29	M	8/1/49	do	+	------	------	------	------	3/25/50
P. M.	22	F	8/3/49	Fever, headache, nausea, vomited, stiff neck.	±	------	------	------	------	-------
A. E.	32	M	8/13/49	Headache, chest pain; died	+	8/14	8/13	8/14	8/14	-------

[1] CSF=13 to 350 cells; average 106 cells/mm.[3]; chiefly lymphocytes.
[2] OP=oropharyngeal exudate.

In addition, mites were obtained as follows:

Source of mites	*Species*
Chicken house	*Dermanyssus gallinae*
Sparrow nest	*Dermanyssus gallinae*
Sparrow nest	*Dermanyssus gallinae*; *Bdella* species
Nest material	*Pteronyssus* species
Nest material	*Liponyssus sylviarum*; *Pteronyssus* species

Tests for viruses. Cerebrospinal fluids and whole blood samples were inoculated intracerebrally into (a) suckling mice, (b) 3-week-old CFW Swiss mice, (c) young adult guinea pigs, and (d) rhesus monkeys (*Macaca mulatta*). Oropharyngeal exudates were prepared for inoculation according to a method described previously (*1*). Fecal samples were emulsified in distilled water (4 parts) and centrifuged in an angle centrifuge (5000 rpm for 30 minutes at 4° C.) Materials obtained from the throat and intestine were inoculated into (a) suckling mice, (b) young Swiss mice, (c) guinea pigs, (d) hamsters, and (e) rhesus monkeys. Usually the intracerebral portal was used, although intranasal (*2*), intraperitoneal (*3*), and subcutaneous portals were used also.

Tests for antibodies. Neutralization (*4*) and complement fixation (*5, 6, 7*) tests were made with the following antigens: WEE, EEE, St. Louis, and the California [2] strains of encephalitis viruses, and mumps and Newcastle disease viruses.

[2] The California strain of virus (*8*) was received from Dr. W. McD. Hammon, School of Public Health, University of Pittsburgh, Pittsburgh, Pa. We are indebted to him for permitting us to include this virus in the present study.

Confirmation of positive results. Histologic studies were made of the central nervous system of animals surviving inoculation more than 48 hours. If fever or apparent illness occurred in animals, some were sacrificed and brain-to-brain passages made. The identification of viruses was made on (a) successful passage in series in susceptible recipients, and (b) neutralization of the agent with previously prepared specific antiserum. Cross protection tests were made with one strain of WEE virus.

Results

Isolation of virus from human specimens. An agent causing encephalitis in mice apparently originated in the blood obtained from patient A. E. and the stool from patient R. S. In each instance virus was adapted to mice from the brain of sick guinea pigs. A résumé of history of passage appears in table 2.

Blood. Whole blood obtained early in illness from patient A. E. was used. The frozen (−70° C.) blood sample was thawed and triturated in a mortar. The blood mixture was clarified by centrifugation and the hemolysate inoculated intracerebrally into 3-day and 3-week-old mice, guinea pigs, and a rhesus monkey (table 3). Suckling mice became ill, but passage was unsuccessful. The rhesus monkey survived 3 weeks without definite clinical symptoms. Meningoencephalitis was observed on histologic examination. Guinea pigs inoculated with blood became sick; they were sacrificed on the 6th and 7th days. Pooled brain emulsion from these guinea pigs was inoculated into eight mice and three guinea pigs. Mice remained healthy for 3 weeks. Two of three guinea pigs became sick, and were sacrificed on the 4th and 12th days, respectively. From one of these guinea pigs an agent causing encephalitis in mice was established and identified by serum neutralization as WEE virus.

Stool. Stool extract obtained early in illness from R. S. was used. The stool was emulsified in distilled water to make a 10-percent suspension (wet weight). Following preliminary centrifugation to sediment crude materials, the emulsion was further centrifuged in the cold at 5000 rpm for 30 minutes (angle centrifuge). The brownish clear fluid was bacteria free. The supernatant fluid was inoculated into infant and 3-week-old mice, guinea pigs, and a rhesus monkey. These animals, with the exception of the guinea pigs, remained healthy during 3 weeks of observation. The guinea pigs showed signs of mild illness 4 to 14 days following inoculation. They were sacrificed, and pooled brain emulsion of these pigs was passaged intracerebrally into eight mice and three guinea pigs. Mice remained healthy for 3 weeks. Two of three guinea pigs became sick and were sacrificed on the 6th and 10th days, respectively. From one of the guinea pigs an agent causing encephalitis in mice was established and identified as WEE virus.

Four months later the same stool extract was inoculated intracerebrally and intraperitoneally into two guinea pigs. These animals became ill and were observed to have tremors and weakness of the legs. They were sacrificed on the 7th and 8th days. Emulsions prepared from the brain of each of these guinea pigs failed to cause illness in 18 young Swiss mice.

The detection of WEE virus in these human milieu have been viewed by us with some reserve. First, it was hard to establish the existence of the virus as evidenced by refractoriness of mice to virus

Table 2. *Detection of WEE virus in blood and stool of human beings ill with encephalitis*

Human materials	History of passages			LD_{50} 5th mouse passage	Neutralization indices [1]	Remarks
	Tissue extracts into guinea pigs	Guinea pig CNS pools, 1st passage	Guinea pig CNS into young mice [2]			
Blood [3] (A. E.)	No. 363 (survived). No. 364 } Sick 4th–7th days, killed No. 365 } 6th–7th days.	No. 366 Sick, killed 4th day. No. 367 Sick, fever, killed 12th day. No. 368 (survived). >	→10/10→5/9→6/6→30/30	$10^{-6.5}$	WEE >32,000 EEE <32 St. Louis <32	Infant mice became ill and died; some were not tested for virus. Young adult mice remained healthy.
Stool [4] (R. S.)	No. 348 } Sick 4th–14th days, killed No. 349 } 14th day.	No. 369 (survived) No. 370 Sick, killed 6th day. No. 371 Sick, killed 10th day. >	→9/11→16/16→→→37/37	$10^{-5.3}$	WEE >3,200 EEE 32 St. Louis 0	Negative test in mice and a rhesus monkey. Patient's serum did not neutralize this virus.

[1] Viruses were tested against antiserums of known titer for WEE, EEE, and St. Louis viruses.
[2] CFW strains of mice were used.
[3] Clot and serum were emulsified in a mortar; supernatant fluid was used following centrifugation at 1,500 rpm.
[4] Supernatant fluid obtained by centrifugation in Swedish angle centrifuge at 5,000 rpm/30′; bacteria free.
10/10=10 died in 2 to 5 days.

NOTE: Uninoculated guinea pigs were caged in a room adjacent to one where pigs were receiving WEE virus in preparation of immune serums. A possibility, that air-borne transfer of virus to uninoculated pigs took place, cannot be eliminated. To the best of our knowledge few, if any, deaths occurred in our small (12 animals) stock guinea pig colony. Unexplained deaths among guinea pigs do occur periodically.

if present in the source of materials. Second, the clinical reaction in guinea pigs inoculated with stool materials was rather indefinite, although a single passage was all that was necessary to establish the presence of a neutrotropic agent infectious for mice. Third, patient R. S. did not develop antibodies either to homotypic or heterotypic (Cox strain) WEE virus. For these reasons the isolation of WEE virus from feces cannot be considered as conclusive evidence of its actual presence there. Although the probability that WEE virus was actually in the vascular shed of A. E., direct serologic evidence could not be established since the patient died a few days after onset of illness. Although we regard these isolations with a critical attitude, we have elected to report them because we do not know that the evidence warrants dismissing them as actual laboratory cross-infections. Further work is necessary to substantiate particularly the isolation of WEE virus from feces. Unfortunately, the human specimens of these patients have been depleted.

The results of additional tests for virus appear in table 3. With the

Table 3. *Tests made to detect filtrable virus in various body milieu of patients sick with encephalitis in Barnes County, North Dakota*

Host	Patient					Remarks
	B. C.	E. C. P.	E. G.	R. S.	A. E.	
				Stool		
Suckling mice [1]	[2] 5/5	0/8	0/7	0/8	0/8	R. S.=positive isolation of virus identified as WEE.
CFW Swiss mice [3]	----------	0/32	1/39	2/10	0/24	
Guinea pigs	0/2	0/3	[3] 3/3	1/3; P=+	0/3	
Rhesus monkeys	0/1	----------	0/1	0/1	0/1	
				Oropharyngeal exudate		
CFW Swiss mice	5/23; P=0	----------	0/2	0/1	[2] 10/10	Monkeys on histology show mild meningo-encephalitis.
Guinea pigs	0/1	----------	0/1	0/6	----------	
Rhesus monkeys	1/1; P=0	----------	1/1	1/1; P=0	1/1; P=0	
				Blood		
Suckling mice	----------	----------	----------	0/5	3/6; P=0	A. E. positive isolation of virus identified as WEE. Monkey=meningo-encephalitis. CSF=287 cells/mm.[3] on 14th day.
CFW Swiss mice	0/15	----------	0/15	0/18	0/10	
Guinea pigs	2/2; P=0	----------	2/2; P=0	1/3; P=0	2/3; P=+	
Rhesus monkeys	----------	----------	----------	----------	1/1; P=0	
				Cerebrospinal fluid		
CFW Swiss mice	----------	----------	----------	0/15	0/8	Monkey=meningo-encephalitis. CSF=96 cells/mm.[3] on 15th day.
Guinea pigs	----------	----------	----------	0/1	----------	
Rhesus monkeys	----------	----------	----------	0/1	1/1	

[1] CFW strain.
[2] Deaths due to bacterial contamination.
[3] CFW strain 3 weeks of age.
0/8=none died of eight inoculated during 21 to 30 days of observations; deaths after 24 hours are recorded only.
P=passage into 2 guinea pigs and/or 10 Swiss mice, or suckling mice.

exception of an imprint of mild encephalitis in rhesus monkeys following inoculation of oropharyngeal exudate and blood, all other efforts to detect virus in various body milieu were negative. All tests made in suckling mice were negative, thereby excluding the likelihood that Coxsackie virus (*9*) was the offending agent. Also the tests made in young mice and guinea pigs, including blind passages, bore negative results, thereby eliminating lymphocytic choriomeningitis. Poliomyelitis virus may be excluded on the basis of tests with stool and oropharyngeal specimens, for the monkeys inoculated with these specimens failed to develop the clinical disease or to demonstrate characteristic histologic lesions. These last results are in contrast to the ease with which poliomyelitis virus was detected in patients diagnosed as having poliomyelitis during the same outbreak, but from a neighboring county. The results of these tests appear in table 4.

Table 4. *Tests made to detect poliomyelitis virus in stools from patients ill with frank poliomyelitis in Bismarck, N. Dak.*

Patient material	Host	Portals	Presence or absence of poliomyelitis virus			
			Original passage	Number additional passages	Tests in rodents	Histologic lesions
W Stool	*M. mulatta*	Intraperitoneal and intranasal.	+	4	Negative	+
L Stool	do	do	+	4	do	+

It has been noted above that subclinical encephalitis was found in rhesus monkeys inoculated intracerebrally with oropharyngeal exudate, blood, and cerebrospinal fluid. The clinical course was mild. The temperature remained normal. Excitement and ataxia were inconstant findings. Cerebrospinal fluid obtained from two or three monkeys showed an increased cell count (96 and 287 cells; about half were lymphocytes). Histologically, there was mild meningo-encephalitis. Lesions were focal and present in midbrain and cortical areas. Neuronal damage and perivascular collars of round cells were present in scattered foci. The chorioid plexuses and the anterior horn cells were undamaged. Passage of apparently infected monkey brain and cerebrospinal fluid into monkeys and mice provided negative clinical and histologic results.

The serologic status of human cases. The results of some serologic studies made with acute and convalescent serums obtained from nine patients appear in table 5. Two of the nine patients had a significantly elevated level of serum antibody neutralizing WEE virus, indicating that these individuals had experienced an attack of western equine encephalitis. One patient (E. G.) had a 400-fold increase in antibody titer. The other patient (G. K.) did not have a demonstrable rise in

Table 5. *Results of neutralization and complement fixation tests with serums obtained from encephalitis patients*

Patient	Neutralization tests								Complement fixation			
	WEE		EEE		St. Louis		California		Mumps		NDV	
	A	C	A	C	A	C	A	C	A	C	A	C
E. G.	10	4,000	------	<32	------	<32	------	<10	0	0	0	0
G. K.	[1] 10,000	3,000	------	<32	------	<32	------	<10	0	0	0	0
I. L.	[1] 10	------	------	------	------	------	------	------	------	------	------	------
E. C. P.	[1] 10	------	------	------	------	------	------	------	------	------	0	0
R. F.	10	10	------	<32	------	<32	------	<10	1:4	1:8	0	0
A. K.	10	10	------	<32	------	<32	------	<10	0	0	0	0
B. R.	10	------	------	------	------	------	------	<10	>1:16	>1:16	0	0
R. S.	10	10	10	10	10	10	------	<10	1:4	1:4	0	0
T. W.	10	10	10	10	10	10	------	<10	0	0	0	0

[1] Actually convalescent serum in 2d or 3d week of illness.
A=acute, or as early as possible after onset of illness.
C=convalescent.

neutralizing antibody titer because serum was not obtained until the 15th day following onset of illness.

In regard to the remaining patients listed in table 5, no serum antibodies were found able to neutralize WEE, EEE, St. Louis, or the California strains of encephalitis viruses or to fix complement in the presence of mumps, St. Louis, or Newcastle disease viruses. Serologic tests with Coxsackie virus have not been made because of the serologic independence of many of these strains. Since Coxsackie virus was not isolated in the outbreak, we have considered this to be likely evidence that this virus was not clinically active in this community.[3]

Because of a possibility of strain peculiarities, the serums of these patients were tested with both the Cox strain and the strain apparently isolated from patient A. E. Entirely similar results were obtained regardless of the strain of virus used in the neutralization tests.

Detection of virus in anthropods. A number of mosquitoes and mites were obtained in Barnes County during a 2-day period in August 1949. An agent, identified as WEE virus, was detected in two lots of mosquitoes (*Culex tarsalis*). The results of these tests appear in table 6. These strains were isolated following initial passage of mosquito extracts into mice. The mice became ill with encephalitis. The strains were passaged four times in mice and identified by serum neutralization tests as WEE virus. Each of these strains caused encephalitis in monkeys, hamsters, and guinea pigs.

The isolation of WEE virus directly from extracts prepared with two lots of *C. tarsalis* was easily accomplished in mice. In contrast, other mosquitoes, namely, *Aedes dorsalis*, *A. vexans*, and *A. nigromaculus*, on extraction failed to yield virus following intracerebral passage in mice. The small samples of mites also were tested in mice with negative results.

[3] Similar studies on serum from patients seen in Bismarck, N. Dak., have provided similar results.

Table 6. *Tests made on mice to detect virus in mosquitoes and mites collected during the middle of August in Valley City, N. Dak.*[1]

Species	Date tested	Results of tests on mice, by intracerebral inoculation of 1/0.03 cc.					
		Morbidity initial passage	Number passages	LD_{50}	Neutralization by Serum		
					WEE	EEE	St. Louis
C. tarsalis (1)	12/2/49	11/29	4	$10^{-7.0}$	10,000	10	10
C. tarsalis (2)	12/19/49	16/16	4	$10^{-7.2}$	10,000+	10	20
A. dorsalis (1)	12/2/49	3/27	0				
A. vexans (1)	do	[2] 6/24	0				
A. vexans (2)	12/14/49	0/18	0				
A. dorsalis (2)	do	1/18	1				
A. nigromaculis	do	2/20	1				
Mites	4/29/50	3/20	0				

[1] Catches were made in and on the periphery of this small town; several catches were made near residences of human cases. Date of collection was Aug. 12–14, 1949.
[2] Contaminated by bacteria; no passage made.

Discussion

At the onset it must be stated that the results presented in this paper contribute nothing that is new in regard to human infection and extra-human hosts in western equine encephalomyelitis. Howitt (*10*) previously has reported the detection of WEE virus in serum obtained from a patient in the acute phase of illness. Isolation of WEE virus from human blood has been a rare event, but it is not an unlikely one provided a sample is taken during a period just prior to onset of central nervous system illness. The detection of virus in feces of an acutely ill patient cannot be viewed as without likelihood of error. It is quite probable in view of the passages made, and particularly in the absence of homotypic humoral antibody, that isolation of WEE virus in a human stool sample was inadvertent and wholly unrelated to the patient's illness. Finally, the detection of WEE in *C. tarsalis* is an old story; however, most of the isolations have been made in California and only one previous isolation has been recorded in the Midwestern States (*11*).

One of the important public health aspects of the outbreak is the recognition that in this small geographic area two, and very probably three, neurotropic virus diseases invaded and caused manifest illness in persons during the summer months. Poliomyelitis and western equine encephalomyelitis viruses were actively present. The demonstrated absence of poliomyelitis and WEE viruses in the majority of the sick adults as indicated by tests made for virus and antibody make it appear more than probable that another neurotropic virus was active in causing the illnesses these persons experienced. Insofar as we have studied this material, we have not been able to define the etiologic agent(s).

Summary

A study has been made of an outbreak of encephalitis in Barnes County, North Dakota, during the summer of 1949. Evidence has been adduced to the effect that in a small geographic area three distinct types of central nervous system illnesses prevailed during a brief period of time. Poliomyelitis and western equine encephalitis occurred. Pertinent, however, is the fact that the majority of those ill did not have antibodies for the recognized neurotropic viruses present in this area, indicating the probable existence of a third neurotropic virus, not as yet detected and identified.

REFERENCES

(*1*) Wenner, H. A.: Effect of H ion concentration on eluting poliomyelitis virus from cotton fiber. Proc. Soc. Exper. Biol. and Med. **60:** 104–106 (1945).

(*2*) Howe, H. A., and Bodian, D.: Efficiency of intranasal inoculation as means of recovering poliomyelitis virus from stools. Am. J. Hyg. **40:** 224–226 (1944).

(*3*) Trask, J. D., Vignec, A. J., and Paul, J. R.: Isolation of poliomyelitis virus from human stools. Proc. Soc. Exper. Biol. and Med. **38:** 147–149 (1938).

(*4*) Paul, J. R.: The Filtrable Viruses. *In* Laboratory Methods of the United States Army, edited by J. S. Simmons and C. J. Gentzkow, Philadelphia, Lea and Febiger, 1944, cf. pp. 592–594.

(*5*) Casals, J., and Palacios, R.: The complement fixation test in the diagnosis of viral infections of the central nervous system. J. Exper. Med. **74:** 409–426 (1941).

(*6*) Enders, J. F., Cohen, S., and Kane, L. W.: Immunity in mumps. II. The development of the complement-fixing antibody and dermal hypersensitivity in human beings following mumps. J. Exper. Med. **81:** 119–135 (1945).

(*7*) Wenner, H. A., Monley, A., and Todd, R. N.: Studies on complement fixation with Newcastle disease virus. J. Immunol. **64:** 323–333 (1950).

(*8*) Hammon, W. McD., and Reeves, W. C.: Recent advances in the epidemiology of anthropod-borne virus encephalitis. Am. J. Pub. Health **35:** 994–1004 (1945).

(*9*) Dalldorf, G., and Sickles, G. M.: An unidentified filtrable agent isolated from the feces of children with paralysis. Science **108:** 61–62 (1948).

(*10*) Howitt, B.: Recovery of the virus of equine encephalomyelitis (western type) from human blood serum. Science **89:** 541–542 (1939).

(*11*) Hammon, W. McD., Reeves, W. D., and Galindo, P.: Epizoology of western equine type encephalomyelitis: Eastern Nebraska field survey of 1943 with isolation of the virus from mosquitoes. Am. J. Vet. Research **6:** 145–148 (1945).

Communities Awarded Milk Sanitation Ratings of 90 Percent or More, July 1949–June 1951

Fifty-four communities have been added to the Public Health Service "honor roll" of safe milk communities in the latest revision of the semiannual publication of the list. At the same time, 21 communities on the previous list have been dropped. This revision covers the period from July 1, 1949, to June 30, 1951, and includes a total of 211 cities and counties.

To achieve a place on the "honor roll," a community must be reported to the Public Health Service, by the State milk sanitation authorities concerned, as having complied substantially during that 2-year period with the various items of sanitation required by the Public Health Service Milk Ordinance. The items include such matters as the health of cows, sanitary methods of handling milk, proper cooling, and adequate pasteurization. The rating of 90 percent or more, which is necessary for inclusion on the list, is computed from the weighted average of the percentages of compliance. Separate lists are compiled for communities in which all market milk is pasteurized and for those in which both raw and pasteurized milk is sold.

The Public Health Service Milk Ordinance, which forms the basis for the milk ratings, is now in effect through voluntary adoption in 369 counties and 1,492 municipalities in 39 States. Thirteen States have placed it in effect on a State-wide basis; it has been adopted as regulation by 34 States and Territories. The ordinance, the rating procedure, and the compilation of this list are the work of the Milk and Food Branch, Division of Sanitation.

Although the ratings do not represent a complete measure of safety, they do indicate how closely a community's milk supply conforms to the standards for grade A milk as stated in the Public Health Service Milk Ordinance. High grade pasteurized milk is safer than high grade raw milk because of the added protection of pasteurization. The list, therefore, shows the percentage of the community's milk which is pasteurized. The Surgeon General has frequently urged consumers who are dependent on raw milk to pasteurize it at home, and has issued instructions on methods of home pasteurization.

Although semiannual publication of the list is intended to encourage communities operating under the Public Health Service Ordinance to attain and maintain a high level of enforcement of its provisions, no comparison is intended with communities operating under other milk ordinances. Some communities might be deserving of inclusion, but

Communities Awarded Milk Sanitation Ratings of 90 Percent or More, July 1949–June 1951

ALL MARKET MILK PASTEURIZED

Community	Percent of milk pasteurized	Date of rating
ALABAMA		
Auburn	100	Sept. 29, 1949
Birmingham and Jefferson County*	100	Nov. 17, 1949
Montgomery	100	May 11, 1950
Opelika	100	June 15, 1950
ARKANSAS		
Fort Smith	100	Dec. 15, 1950
COLORADO		
Colorado Springs	100	Nov. —, 1949
Cortez	100	July —, 1950
Durango	100	July —, 1950
Grand Junction	100	Mar. 29, 1950
FLORIDA		
St. Petersburg	100	Jan. 12, 1950
GEORGIA		
Cairo	100	May 31, 1951
Calhoun	100	Feb. 15, 1951
Columbus	100	Mar. 30, 1951
Cordele	100	Sept. 8, 1949
LaGrange	100	June 25, 1951
Quitman	100	May 30, 1951
West Point	100	June 22, 1951
IDAHO		
Idaho Falls	100	Aug. 24, 1949
ILLINOIS		
Chicago	100	Oct. 28, 1949
Decatur	100	Apr. 27, 1950
East Moline	100	May 18, 1950
Elgin	100	Dec. 8, 1949
Joliet	100	July 14, 1950
Moline	100	May 18, 1950
North Shore Communities	100	Nov. 7, 1949
Glencoe		
Highland Park		
Kenilworth		
Lake Bluff		
Lake Forest		
Northfield		
Skokie		
Winnetka		
Oak Park	100	Sept. —, 1949
Peoria	100	Apr. 15, 1950
Rock Island	100	May 10, 1950
Silvis	100	May 18, 1950
Waukegan	100	Nov. 2, 1949
INDIANA		
Anderson	100	Dec. 19, 1949
Bedford-Orleans	100	Sept. —, 1950
Bluffton	100	Dec. 14, 1950
Calumet Region	100	June —, 1950
East Chicago		
Gary		
Hammond		
Whiting		
Evansville	100	Aug. —, 1950
LaPorte	100	May —, 1950
Marion and Gas City	100	Apr. —, 1951
Shelbyville	100	Oct. —, 1950
South Bend	100	Dec. —, 1949
Vincennes	100	May —, 1951
IOWA		
Clinton	100	July 12, 1950
KANSAS		
Dodge City	100	Apr. 11, 1951
Erie	100	May 1, 1951
Hillsboro	100	Feb. 8, 1951
Kansas City	100	Dec. 11, 1950
Pittsburgh	100	Jan. 26, 1951
KENTUCKY		
Bowling Green and Warren County	100	July 13, 1950
Hopkinsville	100	Mar. —, 1950
Mayfield and Graves County	100	May 11, 1950
Mount Sterling	100	Aug. 16, 1950
Murray	100	Apr. 19, 1950
Owensboro	100	Nov. 17, 1950
Paducah	100	May 5, 1950
Paris	100	May 17, 1951
MISSISSIPPI		
Corinth	100	June 6, 1951
Tupelo	100	Apr. 20, 1951
MISSOURI		
Cape Girardeau	100	Oct. 25, 1950
Chillicothe	100	Oct. 8, 1950
Columbia	100	Dec. 13, 1950
Concordia	100	June 7, 1950
Eldon	100	Dec. 14, 1950
Jackson	100	Oct. 25, 1950
St. Joseph	100	June 14, 1951
NORTH CAROLINA		
Charlotte	100	Feb. 23, 1950
Cumberland County	100	Feb. 10, 1950
Durham County	100	June 8, 1950
Forsyth County	100	Nov. 22, 1950
High Point	100	Feb. 16, 1951
Mars Hill	100	Dec. 9, 1949
New Hanover County	100	June 16, 1950
Randolph County	100	Mar. 9, 1951
Transylvania County	100	Jan. 16, 1950
Wilson	100	Aug. 2, 1950
OKLAHOMA		
Ardmore	100	July 28, 1950
Cushing	100	Feb. 10, 1950
Duncan	100	Oct. 4, 1950
Guthrie	100	May 26, 1950
Sulphur	100	Aug. 29, 1950
SOUTH DAKOTA		
Sioux Falls	100	Sept. 21, 1950
TENNESSEE		
Athens	100	June 14, 1950
Bristol	100	Nov. 4, 1949
Chattanooga	100	Oct. 26, 1949
Columbia	100	Apr. 20, 1950
Covington	100	Aug. 15, 1950
Dyersburg	100	Aug. 17, 1950
Franklin	100	May 5, 1950

*Not operating under milk ordinance recommended by the Public Health Service.

Communities Awarded Milk Sanitation Ratings of 90 Percent or More, July 1949–June 1951—Continued

ALL MARKET MILK PASTEURIZED—Continued

Community	Percent of milk pasteurized	Date of rating
TENNESSEE—continued		
Gallatin	100	May 11, 1951
Greenville	100	Oct. 7, 1949
Kingsport	100	Sept. 23, 1949
Knoxville	100	Sept. 23, 1949
Lawrenceburg	100	Aug. 21, 1950
Lebanon	100	July 19, 1950
Lewisburg	100	Apr. 17, 1950
Manchester	100	Oct. 5, 1950
Morristown	100	Oct. 13, 1949
Nashville and Davidson County	100	Apr. 10, 1950
Newbern	100	Aug. 16, 1950
Paris	100	Apr. 18, 1951
Pulaski	100	May 24, 1951
Springfield	100	May 8, 1951
Sweetwater	100	Oct. 19, 1950
TEXAS		
Bay City	100	May 4, 1950
College Station	100	Sept. 20, 1950
Corpus Christi	100	Oct. 14, 1950
Falfurrias	100	Jan. 12, 1951
Gladewater	100	Jan. 19, 1951
Harlingen	100	Mar. 20, 1950
Houston	100	June 30, 1950
Jacksonville	100	Apr. 12, 1950
Kilgore	100	Jan. 19, 1951
Mission	100	Apr. 5, 1950
Pharr	100	Apr. 5, 1950

Community	Percent of milk pasteurized	Date of rating
TEXAS—continued		
San Antonio	100	Mar. 11, 1950
San Juan	100	Apr. 5, 1950
Sweetwater	100	Apr. 19, 1950
Texarkana	100	Aug. 5, 1950
Texas City	100	Jan. 16, 1951
Tyler	100	Mar. 2, 1950
Weslaco	100	Apr. 5, 1950
Wichita Falls	100	Jan. 31, 1951
UTAH		
Delta	100	Nov. 17, 1950
Minersville	100	Jan. 25, 1951
VIRGINIA		
Boydton	100	Apr. 4, 1950
Bristol	100	Nov. 4, 1949
Buena Vista	100	May 8, 1951
Lawrenceville	100	Apr. 6, 1950
Lexington	100	May 8, 1951
Pulaski	100	June —, 1950
Radford	100	June —, 1950
Richmond	100	May —, 1950
Roanoke	100	Sept. 23, 1950
Staunton	100	Nov. 3, 1950
Suffolk	100	May 24, 1950
WASHINGTON		
Spokane	100	July 21, 1950
Whitman County	100	Aug. 16, 1950

BOTH RAW AND PASTEURIZED MARKET MILK

Community	Percent of milk pasteurized	Date of rating
ALABAMA		
Lanett	97.5	Nov. 9, 1950
GEORGIA		
Camilla	78	May 30, 1951
Cartersville	94.2	Feb. 15, 1951
Dalton-Whitfield County	83.3	Apr. 4, 1951
Macon	98.6	June 15, 1951
Thomaston	79.7	May 24, 1950
Thomasville	99.4	May 29, 1951
INDIANA		
Michigan City	98	May —, 1950
IOWA		
Davenport	99	Jan. 27, 1950
KANSAS		
Neodesha	85	Mar. 14, 1951
KENTUCKY		
Lexington and Fayette Counties	96	June 23, 1950
LOUISIANA		
Iberia Parish	96	May 3, 1951
MISSOURI		
Boonville	87	Oct. 12, 1950
Jefferson City	88.5	July 20, 1950
Moberly	92.5	Oct. 13, 1949
Sedalia	92.5	Aug. 17, 1950
Springfield	99	Nov. 10, 1950

Community	Percent of milk pasteurized	Date of rating
NORTH CAROLINA		
Alexander County	73.5	Mar. 31, 1950
Avery County	73.5	July 12, 1949
Cabarrus County	73.4	Jan. 20, 1950
Greensboro	99.7	July 27, 1950
Henderson County	86	Feb. 6, 1950
Iredell County	95.7	Oct. 27, 1950
Macon County	91.4	Aug. 10, 1950
Montgomery County	93.1	Mar. 22, 1951
Orange County	96.1	May 11, 1950
Wilkes County	89.7	Jan. 25, 1950
OKLAHOMA		
Elk City	95.5	July 12, 1950
Holdenville	89	Mar. 28, 1950
Lawton	96.2	Feb. 20, 1950
Mangum	93.8	June 29, 1950
Norman	94.1	Sept. 22, 1950
Ponca City	93.1	Sept. 15, 1950
Stillwater	96	July 7, 1949
Sulphur	98	Sept. 6, 1949
TENNESSEE		
Cleveland	94.4	Sept. 7, 1950
Elizabethton	94	Aug. 8, 1950
Jackson	95.8	Mar. 30, 1950
Johnson City	96.6	Aug. 9, 1950
Maryville-Alcoa	99.2	Oct. 17, 1950
McMinnville	95.1	May 25, 1950
Murfreesboro	98	July 27, 1949
TEXAS		
Beaumont	99.4	Oct. 20, 1950
Brenham	92	Apr. 15, 1950
Brownsville	84.8	Mar. 20, 1950
Bryan	98.8	Sept. 21, 1950

Communities Awarded Milk Sanitation Ratings of 90 Percent or More, July 1949-June 1951—Continued

BOTH RAW AND PASTEURIZED MARKET MILK—Continued

Community	Percent of milk pasteurized	Date of rating	Community	Percent of milk pasteurized	Date of rating
TEXAS—continued			VIRGINIA		
Cleburne	91 5	Nov. 17, 1950	Emporia	34	Apr. 7, 1950
Corsicana	99 6	Jan. 31, 1950	Lynchburg	98. 2	June 22, 1951
Edinburg	85 9	Apr. 5, 1950			
Fort Worth	99 95	Feb. 4, 1950			
Laredo	62	Aug. 24, 1950			
Longview	99. 4	Jan. 19, 1951			
Lubbock	99. 2	Nov. 8, 1950			
McAllen	98. 4	Apr. 5, 1950			
Paris	92. 4	Nov. 16, 1950			

NOTE.—In these communities the pasteurized market milk shows a 90-percent or more compliance with the grade A pasteurized milk requirements and the raw market milk shows a 90-percent or more compliance with the grade A raw milk requirements of the Public Health Service Milk Ordinance and Code.

Note particularly the percentage of milk pasteurized in the various communities listed. This percentage is an important factor to consider in estimating the safety of a city's milk supply. All milk should be pasteurized or boiled, either commercially or at home, before it is consumed.

they cannot be listed because no arrangements have been made for determination of their ratings by the State milk sanitation authority concerned. In other cases, the ratings which were submitted have lapsed because they were over 2 years old. Still other communities, some of which may have high grade milk supplies, have indicated no desire for rating or inclusion.

The rules for inclusion of a community on the "honor roll" are:

1. All ratings must be determined by the State milk sanitation authority in accordance with the Public Health Service rating method,[1] which is based upon the grade A pasteurized milk and the grade A raw milk requirements of the Public Health Service Milk Ordinance. (A recent departure from the method described consists of computing the pasteurized milk rating by weighting the pasteurization plant rating twice that of the raw milk intended for pasteurization.)

2. No community will be included in the list unless both its pasteurized milk and its raw milk ratings are 90 percent or more. Communities in which only raw milk is sold will be included if the raw milk rating is 90 percent or more.

3. The rating used will be the latest submitted to the Public Health Service, but no rating will be used which is more than 2 years old. (In order to promote continuous rigid enforcement rather than occasional "clean-up campaigns," it is suggested that when the rating of a community on the list falls below 90 percent no resurvey be made for at least 6 months. This will result in the removal of the community from the subsequent semiannual list.)

4. No community will be included on the list whose milk supply is not under an established program of official routine inspection and laboratory control provided by itself, the county, a milk control district, or the State. (In the absence of such an official program there can be no assurance that only milk from sources rating 90 percent or more will be used continuously.)

5. The Public Health Service will make occasional check surveys of cities for which ratings of 90 percent or more have been reported by the State. (If the check rating is less than 90 percent, but not less than 85, the city will be removed

[1] Pub. Health Rep. 53:1386 (1938). Reprint No. 1970.

from the 90-percent list after 6 months unless a resurvey submitted by the State during this probationary interim shows a rating of 90 percent or more. If the check rating is less than 85 percent, the city will be removed from the list immediately. If the check rating is 90 percent or more, the city will be retained on the list for 2 years from the date of the check survey, unless a subsequent rating during this period warrants its removal.)

State milk sanitation authorities who are not now equipped to determine municipal ratings are urged, in fairness to their communities, to equip themselves as soon as possible. The personnel required is small; in most States one milk sanitarian is sufficient for this work.

Public Health Service Publications

July–December 1950

This list is issued to provide a complete and continuing record of Public Health Service publications for reference use by librarians, scientists, researchers, and others interested in public health work, and not to offer the publications for indiscriminate free distribution.

Single sample copies of most of the publications listed are available from the Public Inquiries Branch, Division of Public Health Methods, Public Health Service, Washington 25, D. C.

For quantities of any of these publications, except the statistical reports of the National Office of Vital Statistics, order from the Government Printing Office, where they are available at the prices shown, with a 25 percent reduction on orders of 100 or more copies of any single publication. The statistical reports of the National Office of Vital Statistics can be obtained only by writing to the National Office of Vital Statistics, Public Health Service, Washington 25, D. C.

PERIODICALS

*Public Health Reports (weekly), July–December, vol. 65, Nos. 27–52. 851–1764 pages. 10 cents a copy. Subscription price $4.75 a year.

*Extracts from Public Health Reports (monthly), July–December, Tuberculosis Control Issues Nos. 53–58. Average 30 pages each. 10 cents a copy. Subscription price $1 a year.

*The Journal of Venereal Disease Information (monthly), July–December, vol. 31, Nos. 7–12. 173–347 pages. 15 cents a copy. Subscription price $1.25 a year.

*Journal of the National Cancer Institute (bimonthly), August to December, vol. 11, Nos. 1–3. 1–662 pages. $1.50 a copy. Subscription price $8 a year.

Public Health Engineering Abstracts (monthly), July–December, vol. XXX, Nos. 7-12. Usually 32 pages each. No sales stock.

*Industrial Hygiene Newsletter (monthly), July–December, vol. 10, Nos. 7–12. Usually 16 pages each. 10 cents a copy. Subscription price $1 a year.

CDC Bulletin (monthly), July–December, vol. IX, Nos. 7–12. No sales stock.

NONPERIODIC PUBLICATIONS

Librarians, Please Note

Nearly all publications on this list carry the designation "Public Health Service Publication No. —." This does not represent a new series, but is a registration system adopted late in 1950 as an internal housekeeping measure. Under the numbering plan, all nonperiodic

*Subscriptions to this periodical can be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

issuances carry this designation, which is assigned consecutively at the time of going to press. Publications issued prior to adoption of the numbering plan do not carry this designation and will not be incorporated into the system unless they are reissued.

The following series have been discontinued:

- Supplements to Public Health Reports—last issued: No. 213 (1950).
- Supplements to Journal of Venereal Disease Information—last issued: No. 23 (1949).
- National Institutes of Health Bulletins—last issued: No. 193 (in press).
- Public Health Bulletins—last issued: No. 306 (1949). (A bulletin on rural health cooperatives, jointly prepared by the Farm Credit Administration and the Public Health Service which was published by the Farm Credit Administration, was erroneously identified as Public Health Bulletin No. 308.)
- Venereal Disease Bulletins—last issued: No. 100 (1949).

Series to Continue. Publications with a subject and field homogeneity will continue to be issued in series. In addition to the registration number given them under the over-all numbering system, they will carry the conventional series notation long familiar to librarians. Publications issued as part of a series are shown first on this list.

Missing Numbers. Under the new numbering system, publications are assigned registration numbers at the time they go to the printer. Variations in printing schedules result in publications being released out of the consecutive order of the Public Health Service Publications number, and some will be temporarily missing. One publication (No. 36), prepared for in-service use and not for general distribution, was inadvertently numbered. No. 36, therefore, will be permanently missing from library files.

PUBLIC HEALTH BIBLIOGRAPHY SERIES*

2. Catalog of mental health pamphlets and reprints available for distribution, 1950. 1950. 55 pages. 20 cents. (PHS Publication No. 19.)

CANCER MORBIDITY SERIES*

1. Cancer illness among residents in Atlanta, Ga., 1947. By Sidney J. Cutler, 1950. 43 pages. No sales stock. (PHS Publication No. 13.)

CANCER PAMPHLET SERIES

6. Cancer of the genito-urinary tract. 1950. 20 pages. 10 cents; $5 per 100.
7. Cancer of the skin. 1950. 19 pages. 10 cents; $5 per 100.

HEALTH INFORMATION PAMPHLET SERIES

9. Arthritis and rheumatism. July 1950. 6-page folder. 5 cents; $1.75 per 100. (PHS Publication No. 29.)
33. Tuberculosis. June 1950. 12 pages. 5 cents; $3.75 per 100. (PHS Publication No. 30.)

* New series.

MENTAL HEALTH SERIES

2. Training and research opportunities under the National Mental Health Act. Revised June 1950. 11 pages. 14 pages mimeographed inserts. 10 cents. (PHS Publication No. 22.)
4. National Institute of Mental Health. Revised 1950. 21 pages. 10 cents. (PHS Publication No. 20.)
5. Careers in mental health. 1950. 19 pages. 15 cents. (PHS Publication No. 23.)

5A. Careers in mental health . . . as a psychiatrist. 1950. 13 pages. 10 cents. (PHS Publication No. 25.)

5B. Careers in mental health . . . as a psychiatric nurse. 1950. 13 pages. 10 cents. (PHS Publication No. 26.)

5C. Careers in mental health . . . as a clinical psychologist. 1950. 13 pages. 10 cents. (PHS Publication No. 27.)

5D. Careers in mental health . . . as a psychiatric social worker. 1950. 12 pages. 10 cents. (PHS Publication No. 28.)

PUBLIC HEALTH MONOGRAPH SERIES*

1. A methodology for environmental and occupational cancer surveys. By W. C. Hueper. 1950. 37 pages. 15 cents. (PHS Publication No. 12.)
2. Tuberculosis in Iceland. Epidemiological studies. By Sigurdur Sigurdsson. 1950. 86 pages. 45 cents. (PHS Publication No. 21.)

OTHER PUBLICATIONS

Cancer diagnostic tests. Principles and criteria for development and evaluation. By John E. Dunn, Jr., and Samuel W. Greenhouse. 1950. 23 pages. 20 cents. (PHS Publication No. 9.)

Cancer services and facilities in the United States, 1950. 1950. 152 pages. 35 cents. (PHS Publication No. 14.)

Clean water is everybody's business. 1950. 26 pages, illustrated. 20 cents. (PHS Publication No. 11.)

Conservation of hearing. 1950. 8 pages, illustrated. No sales stock. (PHS Publication No. 1.)

Conservation of vision. 1950. 8 pages, illustrated. No sales stock. (PHS Publication No. 3.)

The dietitian in the hospitals of the U. S. Public Health Service. 1950. 24 pages, illustrated. 15 cents. (PHS Publication No. 35.)

Handbook for photofluorographic operators. 1950. 69 pages, illustrated. 45 cents. (PHS Publication No. 18.)

Health of ferrous foundrymen in Illinois. 1950. 130 pages, illustrated. 75 cents. (PHS Publication No. 31.)

Heart disease, a story of progress. 1950. 20 pages. 15 cents. (PHS Publication No. 17.)

Home care. 1950. 8 pages, illustrated. No sales stock. (PHS Publication No. 4.)

Index of hospitals with tuberculosis beds in the United States and Territories as of January 1, 1950. 1950. 21 pages. No sales stock. (PHS Publication No. 32.)

Individual water supply systems. Recommendations of the Joint Committee on Rural Sanitation. Revised 1950. 61 pages. 20 cents. (PHS Publication No. 24.) (Formerly Supplement 185, Public Health Reports.)

Industrial health and medical programs. By Margaret C. Klem, Margaret F. McKiever, and Walter J. Lear. September 1950. 397 pages. $1. (PHS Publication No. 15.)

Long term illness. 1950. 8 pages, illustrated. Out of print. (PHS Publication No. 2.)

Manual for medical examination of aliens. 1950. 136 pages. (For official use only.)

Manual of recommended practice for sanitary control of the shellfish industry. 1946 recommendations of the Public Health Service. 1950. 44 pages. 20 cents. (PHS Publication No. 33.) (Formerly Public Health Bulletin No. 295.)

Medical rehabilitation. 1950. 8 pages, illustrated. Out of print. (PHS Publication No. 5.)

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3060. Public health: 1950. A topical and selective report of the Seventy-eighth Annual Meeting of the American Public Health Association and Related Organizations, St. Louis, Mo., October 30–November 3, 1950. December 8 and 15, 1950. 84 pages. 30 cents.

3061. Public Health Service publications, January–June 1950. December 22, 1950. 8 pages. No sales stock.

3062. Causes of absenteeism in New Haven schools. By Joseph I. Linde, Abraham Gelperin, and Morris A. Granoff. December 29, 1950. 8 pages. 5 cents.

SUPPLEMENT TO PUBLIC HEALTH REPORTS

194. Directory of full-time local health officers, 1950. 1950 revision. 49 pages. 20 cents.

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Index to Public Health Reports, vol. 64, pt. I, January–June 1949. 40 pages. 10 cents.

REPRINTS FROM JOURNAL OF THE NATIONAL CANCER INSTITUTE*

215. The growth of normal plant tissue *in vitro* as affected by chemical carcinogens and plant growth substances. II. The cytology of the carrot-root tissue. By Michael Levine. April 1950. 37 pages; 11 illustrations.
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217. Production of malignancy *in vitro*. X. Continued description of cells at the glass interface of the cultures. By Wilton R. Earle, Edward L. Schilling, and Emma Shelton. April 1950. 37 pages; 11 illustrations.
218. Production of malignancy *in vitro*. XI. Further results from reinjection of *in vitro* cell strains into strain C_3H mice. By Wilton R. Earle, Emma Shelton, and Edward L. Schilling. April 1950. 9 pages.
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224. Comparative studies of liver glucuronidase activity in inbred mice. By Andrew G. Morrow, Ezra M. Greenspan, and Dorothy M. Carroll. April 1950. 5 pages.
225. Studies of the carcinogenic action in the rat of 2-nitro-, 2-amino-, 2-acetylamino-, and 2-diacetylaminofluorene after ingestion and after painting. By Harold P. Morris, Celia S. Dubnik, and James M. Johnson. June 1950. 13 pages.
226. Studies of the effects *in vitro* of roentgen radiation on the biological activity of the agent of chicken tumor I (Rous sarcoma). By W. Ray Bryan, Egon Lorenz, and John B. Moloney. June 1950. 23 pages.
227. Formation of tyrosine crystals from leukocytes and various normal and pathological tissues by means of a synthetic detergent. By William W. Ayres. June 1950. 19 pages; 4 illustrations.
228. Note on the influence of the number of litters upon the incidence of mammary tumors in mice. By O. Muhlbock. June 1950. 4 pages.
229. Lactic dehydrogenase activity of certain tumors and normal tissues. By Alton Meister. June 1950. 9 pages.
230. Damage induced in sarcoma 37 with podophyllin, podophyllotoxin, alpha-peltatin, beta-peltatin, and quercetin. By J. Leiter, V. Downing, J. L. Hartwell, and M. J. Shear. June 1950. 21 pages; 2 illustrations.

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231. Effect of alpha-peltatin, beta-peltatin, and podophyllotoxin on lumphomas and other transplanted tumors. By Ezra M. Greenspan, J. Leiter, and M. J. Shear. June 1950. 39 pages; 9 illustrations.

232. The Histochemical Society. First business meeting and proceedings, University of Pennsylvania School of Medicine, Philadelphia, Pa., March 24 and 25, 1950. June 1950. 45 pages.

REPRINTS FROM THE JOURNAL OF VENEREAL DISEASE INFORMATION

399. A proposal for joint action against congenital syphilis. By Betty Huse and W. H. Aufranc. July 1950. 4 pages. 5 cents.

400. Status of treatment of syphilitic pregnant women and of children who have congenital syphilis. By Mary S. Goodwin. July 1950. 8 pages. 5 cents.

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418. The antigens of the cultured *Treponema pallidum* (Reiter's strain) and the antispirochetal antibodies in human syphilis. By G. D'Alessandro, F. G. Oddo, and L. Dardanoni. December 1950. 2 pages. 5 cents.

NATIONAL OFFICE OF VITAL STATISTICS PUBLICATIONS*

Current Mortality Analysis (monthly), vol. 8, Nos. 4–9, 1950.

Monthly Marriage Report (marriage licenses issued in major cities), vol. 4, Nos. 5–10, 1950.

Monthly Vital Statistics Bulletin, vol. 13, Nos. 5–10, 1950.

Weekly Mortality Index, vol. 21, Nos. 26–51, 1950.

Weekly Morbidity Report, vol. 1, Nos. 25–50, 1950.

Communicable Disease Summary, weeks ending June 24, 1950–December 30, 1950.

Vital Statistics—Special Reports, Vol. 32, Cancer Mortality in the United States

2. Available cancer mortality data and some problems in their interpretation: United States. 15–40 pages.
3. Cancer mortality for selected sites, by age, sex, and race: United States, 1930–45. 41–154 pages.
4. Cancer mortality for selected years: United States and each State, 1900–1945. 155–180 pages.
5. Cancer deaths in institutions: United States, 1940 and 1945. 181–204 pages.
6. Cancer mortality by marital status: United States, 1940. 205–236 pages.
7. Effect of cancer on longevity: United States, 1939–41. 237–242 pages.
8. Cancer mortality by State and county: United States, 1945. 243–272 pages.
9. Cancer mortality by urban and rural areas: United States, 1945. 273–284 pages.

Vital Statistics—Special Reports, Vol. 33, Selected Studies

7. Investigation of separation factors, at ages 1–4, based on 10-percent mortality sample. 127-132 pages.
8. Births and birth rates in the entire United States, 1909–48. 133–162 pages.

Vital Statistics—Special Reports, Vol. 34, State Summaries

30–54. New Mexico–Wyoming, United States, Hawaii, Puerto Rico, Virgin Islands, Alaska. 523–993 pages.

Vital Statistics—Special Reports, Vol. 35. National Summaries

12. Divorce and annulment statistics: specified States, 1948. 161–186 pages.
13. Infant mortality from selected causes by age, race, and sex: United States, 1948. 187–220 pages.
14. Accident fatalities in the United States, 1948. 221–240 pages.
15. Motor-vehicle accidents fatalities, United States, 1948. 241–292 pages.
16. Stillbirth statistics, United States, each division and State, and 92 major cities, 1948. 293–302 pages.
17. Infant mortality by race and by urban and rural areas: United States, each division and State, 1948. 303–312 pages.
18. Deaths and death rates for selected causes by age, race, and sex: United States, 1948. 313–346 pages.
19. Maternal mortality by cause, race, and urban and rural areas: United States, each division and State, 1948. 347–360 pages.

*Available only from the National Office of Vital Statistics, Public Health Service, Washington 25, D. C.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended August 4, 1951

Poliomyelitis

A total of 1,203 cases of poliomyelitis was reported in the United States for the current week as compared with 990 for the previous week. For the same weeks in 1949 and 1950, 2,446 and 1,185 cases, respectively, were reported. The cumulative total for the calendar year is now 6,843 as compared with 10,719 in 1949, and 7,298 in 1950. The cumulative total since the seasonal low week late in March is 5,631 as compared with 9,806 and 6,167, respectively, in 1949 and 1950.

With few exceptions States in all geographical regions reported more cases for the current week as compared with the previous week, but there was no marked increase in California, Texas, Colorado, and Louisiana, where substantial numbers of cases have been reported in the past month. The increase in most of the remaining States appears to represent an expected seasonal rise.

In Texas, poliomyelitis has been concentrated in seven counties. Of the 546 cases reported in the entire State, from May 1 to July 28, 25 were in Bexar, 41 in Dallas, 83 in Harris, 96 in Nueces, 26 in San Patricio, 46 in Tarrant, and 16 in Wichita Counties. In five of the seven counties the peak number of cases was reached before July 15.

.In Mississippi, the disease has been concentrated in a group of four counties in the west central part of the State. During the 4-week period ended July 28, 102 cases were reported in Mississippi of which number 28 were in Sunflower, 9 in Washington, 5 in Bolivar, and 4 in Leflore Counties. The largest number reported in any one week in Sunflower County was 14 for the week ended July 21. In 1950, totals of 24, 22, 10, and 10 cases, respectively, were reported in the above group of counties.

In Louisiana, poliomyelitis incidence appears to have passed its peak. In Caddo Parish, where 72 cases were reported in 9 weeks ended July 28, the largest number was reported for the week ended July 21. In Red River Parish, 10 cases were reported for the week ended July 7, and only 1 in the following 3 weeks.

In certain other States such as California, Utah, Colorado, Wisconsin, Illinois, Kansas, and Michigan, a large proportion of cases in recent weeks have been reported from urban areas. In Michigan, nearly three-fourths of the cases reported have been in Detroit and other parts of Wayne County. In Arkansas, about one-half of the 99 cases reported in the first 7 months of 1951 have occurred in Pulaski and Jefferson Counties. There have been 55 paralytic cases, 26 nonparalytic, and 18 unspecified.

Human Rabies

One case of human rabies was reported in Georgia for the current week.

Epidemiological Reports

Tularemia

Dr. M. E. Rindge, Connecticut Department of Health, has reported a case of tularemia in a 17-year-old boy who was scratched by a cat on June 23 while visiting in North Carolina. He became ill on June 27. He was admitted to a hospital in Connecticut on July 13 with typical ulcers at the site of the scratches and large axillary nodes. Agglutination reactions were strongly positive. Recovery was rapid following treatment with terramycin.

Gastroenteritis

Dr. S. V. Dugan, Kentucky Department of Health, has reported two outbreaks of gastroenteritis. Five of eight persons who ate a frosted, filled cake in a restaurant in Mercer County became ill 3½ hours later. A family outbreak consisting of four cases occurred in Allen County. A homemade chocolate pie or raw buttermilk was suspected as being the vehicle. The source of the milk was an unsanitary three-cow dairy where raw milk and buttermilk were sold.

Infectious Hepatitis

Dr. C. C. Kuehn, Louisiana Department of Health, has reported a localized outbreak of infectious hepatitis in Baton Rouge. The parish health officer, Dr. J. D. Martin, states that six of the seven cases reported were between the ages of 4 and 9. All were white persons. The first cases were reported early in June, and the last in the middle of July.

Water-Borne Gastroenteritis

Dr. F. S. Leeder, Michigan Department of Health, has reported an outbreak of gastroenteritis in Macomb County in which the public water supply presumably was the source of infection. The outbreak, which was explosive in character, began on July 23 and affected approximately 3,500 persons in a community having a population of 7,643. One or more persons in nearly every household were affected.

Epidemiological investigation by Dr. Stryker, county health officer, indicated that the only vehicle that could be considered common to all was the water supply which came from wells. A severe rainstorm occurred on July 21. At the time of the outbreak, the water supply was unchlorinated. Water samples collected on July 25 revealed no growth when examined bacteriologically.

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Aug. 4, 1951	Aug. 5, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	2	2	1	(1)	(1)	(1)	(1)	44	29	32
Diphtheria (055)	56	63	126	27th	175	239	431	2,183	3,367	5,043
Encephalitis, acute infectious (082)	42	20	19	(1)	(1)	(1)	(1)	582	472	333
Influenza (480–483)	250	439	300	30th	250	439	300	116,305	139,203	128,857
Measles (085)	2,708	1,906	1,906	35th	490,846	303,490	580,926	462,145	284,360	545,980
Meningitis, meningococcal (057.0)	79	43	57	37th	3,739	3,456	3,355	2,778	2,543	2,383
Pneumonia (490–493)	615	873	(2)	(1)	(1)	(1)	(1)	45,154	59,342	(2)
Poliomyelitis, acute (080)	1,203	1,185	1,237	11th	[3] 5,631	6,167	6,167	[3] 6,843	7,298	7,030
Rocky Mountain spotted fever (104)	21	22	38	(1)	(1)	(1)	(1)	219	299	353
Scarlet fever (050) [4]	387	257	312	32d	68,812	56,352	79,965	53,121	39,913	57,421
Smallpox (084)	-------	-------	1	35th	17	44	69	9	24	48
Tularemia (059)	10	16	24	(1)	(1)	(1)	(1)	416	612	619
Typhoid and paratyphoid fever (040,041) [5]	79	109	124	11th	1,055	1,399	1,485	1,490	1,909	1,958
Whooping cough (056)	1,338	2,602	2,519	39th	[6] 67,140	103,338	86,815	[6] 45,538	81,802	60,231

[1] Not computed. [2] Data not available. [3] Deductions: Arkansas, weeks ended July 21 and July 28, 1 case each; Kentucky, week ended March 31, 1 case. [4] Including cases reported as streptococcal sore throat. [5] Including cases reported as salmonellosis. [6] Addition: Rhode Island ,week ended July 28, 12 cases.

Reported Cases of Selected Communicable Diseases: United States, Week Ended August 4, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**56**	**42**	**250**	**2,708**	**79**	**615**	**1,203**
New England	**1**	-	**2**	**277**	**2**	**13**	**43**
Maine	-	-	2	42	-	4	1
New Hampshire	-	-	-	5	-	1	9
Vermont	-	-	-	29	1	-	2
Massachusetts	1	-	-	136	-	-	19
Rhode Island	-	-	-	26	-	-	-
Connecticut	-	-	-	39	1	8	12
Middle Atlantic	**3**	**19**	-	**616**	**9**	**45**	**117**
New York	1	17	(1)	330	4	-	65
New Jersey	-	1	-	155	-	18	17
Pennsylvania	2	1	-	131	5	27	35
East North Central	**1**	**4**	**8**	**635**	**14**	**50**	**235**
Ohio	-	-	-	109	6	-	37
Indiana	-	-	6	5	1	2	10
Illinois	-	1	-	181	4	33	81
Michigan	1	3	2	56	2	15	73
Wisconsin	-	-	-	284	1	-	34
West North Central	**4**	**3**	-	**139**	**9**	**85**	**123**
Minnesota	3	1	-	11	3	4	28
Iowa	-	-	-	20	2	-	14
Missouri	-	-	-	55	1	2	12
North Dakota	-	1	-	24	-	77	5
South Dakota	-	-	-	4	-	-	5
Nebraska	-	-	-	14	-	-	23
Kansas	1	1	-	11	3	2	36
South Atlantic	**16**	**5**	**102**	**297**	**14**	**141**	**115**
Delaware	-	-	-	2	-	-	1
Maryland	-	3	1	147	-	22	1
District of Columbia	-	-	-	7	-	13	4
Virginia	1	-	53	60	4	18	11
West Virginia	1	-	-	7	3	-	9
North Carolina	3	-	-	14	2	-	21
South Carolina	7	-	5	1	-	2	3
Georgia	1	2	43	20	3	86	49
Florida	3	-	-	39	2	-	16
East South Central	**9**	**2**	**1**	**64**	**6**	**45**	**126**
Kentucky	5	-	-	21	2	-	15
Tennessee	1	1	-	28	4	-	30
Alabama	2	1	-	12	-	24	43
Mississippi	1	-	1	3	-	21	38
West South Central	**15**	**4**	**42**	**156**	**15**	**176**	**201**
Arkansas	-	-	18	23	2	32	23
Louisiana	5	-	3	5	3	20	34
Oklahoma	-	-	21	8	-	5	52
Texas	10	4	-	120	10	119	92
Mountain	**3**	**1**	**87**	**131**	-	**20**	**111**
Montana	-	-	17	41	-	-	2
Idaho	-	-	-	4	-	-	-
Wyoming	1	-	-	12	-	-	9
Colorado	1	-	3	16	-	12	71
New Mexico	-	-	-	6	-	3	2
Arizona	1	-	67	28	-	5	3
Utah	-	1	-	23	-	-	23
Nevada	-	-	-	1	-	-	1
Pacific	**4**	**4**	**8**	**393**	**10**	**40**	**132**
Washington	-	-	3	19	2	-	8
Oregon	1	-	-	50	-	8	14
California	3	4	5	324	8	32	110
Alaska	-	-	-	-	-	1	-
Hawaii	-	-	-	39	-	-	1

[1] New York City only.

Anthrax: California and Kentucky, 1 case each.

Reported Cases of Selected Communicable Diseases: United States, Week Ended August 4, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	21	387	-	10	79	1,338	82
New England	-	25	-	-	3	79	-
Maine	-	-	-	-	-	12	-
New Hampshire	-	4	-	-	-	6	-
Vermont	-	-	-	-	-	11	-
Massachusetts	-	16	-	-	2	43	-
Rhode Island	-	1	-	-	-	1	-
Connecticut	-	4	-	-	1	6	-
Middle Atlantic	1	100	-	-	6	171	16
New York	-	79	-	-	-	67	12
New Jersey	-	6	-	-	1	53	-
Pennsylvania	1	15	-	-	5	51	4
East North Central	1	74	-	-	5	196	11
Ohio	-	24	-	-	3	39	-
Indiana	-	2	-	-	1	32	9
Illinois	1	12	-	-	1	27	-
Michigan	-	27	-	-	-	43	1
Wisconsin	-	9	-	-	-	55	1
West North Central	-	29	-	-	6	81	9
Minnesota	-	2	-	-	-	2	-
Iowa	-	2	-	-	-	17	3
Missouri	-	2	-	-	3	21	5
North Dakota	-	-	-	-	-	3	-
South Dakota	-	19	-	-	-	-	-
Nebraska	-	1	-	-	-	3	1
Kansas	-	3	-	-	3	35	-
South Atlantic	15	33	-	4	12	237	17
Delaware	-	-	-	-	-	-	-
Maryland	2	6	-	-	-	12	-
District of Columbia	-	-	-	-	-	17	-
Virginia	6	2	-	4	1	31	3
West Virginia	1	7	-	-	3	40	-
North Carolina	5	11	-	-	3	57	-
South Carolina	-	4	-	-	-	5	11
Georgia	1	-	-	-	5	38	3
Florida	-	3	-	-	-	37	-
East South Central	2	27	-	2	16	93	9
Kentucky	1	6	-	-	3	33	-
Tennessee	1	12	-	2	3	35	2
Alabama	-	4	-	-	8	12	5
Mississippi	-	5	-	-	2	13	2
West South Central	1	14	-	3	17	316	20
Arkansas	1	1	-	2	5	14	4
Louisiana	-	2	-	-	4	-	-
Oklahoma	-	2	-	-	1	46	1
Texas	-	9	-	1	7	256	15
Mountain	1	9	-	1	4	101	-
Montana	-	-	-	-	-	11	-
Idaho	-	3	-	-	2	3	-
Wyoming	-	-	-	1	-	1	-
Colorado	-	2	-	-	2	17	-
New Mexico	-	2	-	-	-	20	-
Arizona	-	-	-	-	-	42	-
Utah	1	2	-	-	-	7	-
Nevada	-	-	-	-	-	-	-
Pacific	-	76	-	-	10	64	-
Washington	-	5	-	-	-	7	-
Oregon	-	2	-	-	-	4	-
California	-	69	-	-	10	53	-
Alaska	-	-	-	-	-	5	-
Hawaii	-	-	-	-	1	-	-

[1] Including cases reported as streptococcal sore throat. [2] Including cases reported as salmonellosis.

Rabies in Man: Georgia, 1 case.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases, Week Ended July 21, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	4					3			1		
Chickenpox	514	4		22		76	244	29	26	79	34
Diphtheria	4	2				1			1		
Dysentery:											
Amebic	1						1				
Bacillary	12					4		1			7
Encephalitis, infectious	1						1				
German measles	78			2		4	33		3	12	24
Influenza	4			4							
Measles	529	25		58	3	118	57	28	16	133	91
Meningitis, meningococcal	2								2		
Mumps	213	10		1		31	74	11	7	12	67
Poliomyelitis	37			4		2	24	1	2	1	3
Scarlet fever	83					20	17	23	6	8	9
Tuberculosis (all forms)	203			1	9	52	21	17	9	14	80
Typhoid and paratyphoid fever	7	1				5					1
Venereal diseases:											
Gonorrhea	276	5		4	14	53	53	18	23	55	51
Syphilis	99	2		5	9	40	18	4	8	3	10
Primary	15				3	5	6	1			
Secondary	5					2	1		1	1	
Other	79	2		5	6	33	11	3	7	2	10
Whooping cough	108			7		35	30	5	14	11	6

*Week Ended July 7, 1951**

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	3					2	1				
Chickenpox	622	2		21		44	323	18	45	66	103
Diphtheria	2						1				1
Dysentery, bacillary	2										2
Encephalitis, infectious	2						2				
German measles	95			11		14			4	16	50
Influenza	27			25	1			1			
Measles	858	4		61	8	208	145	27	19	226	160
Meningitis, meningococcal	3	1					1	1			
Mumps	307	9		4		32	130	5	30	21	76
Poliomyelitis	30			8		2	19				1
Scarlet fever	181	1				34	36	24	14	39	33
Tuberculosis (all forms)	253	13		2	13	132	26	20	9	18	20
Typhoid and paratyphoid fever	9					5				1	3
Venereal diseases:											
Gonorrhea	250	11		2	11	58	40	27	12	41	48
Syphilis	93	3		3	3	56	18	1	2	1	6
Primary	10				2	7			1		
Secondary	1					1					
Other	82	3		3	1	48	18	1	1	1	6
Whooping cough	119	1			1	44	33	6	3	10	21

*Delayed report.

FINLAND

Reported Cases of Certain Diseases—June 1951

Disease	Cases	Disease	Cases
Diphtheria	58	Typhoid fever	2
Dysentery	1	Venereal diseases:	
Meningitis, meningococcal	9	Gonorrhea	426
Paratyphoid fever	37	Syphilis	20
Poliomyelitis	3	Other forms	3
Scarlet fever	1,732		

NEW ZEALAND

Reported Cases of Certain Diseases and Deaths for 2 Periods

4 Weeks Ended May 26, 1951

Disease	Cases	Deaths	Disease	Cases	Deaths
Brucellosis	5		Influenza	1	
Diphtheria	6		Meningitis, meningococcal	6	1
Dysentery:			Poliomyelitis	4	
Amebic	12		Puerperal fever	2	
Bacillary	5		Scarlet fever	80	
Encephalitis, infectious	2		Trachoma	2	
Erysipelas	10		Tuberculosis (all forms)	167	33
Food poisoning	2		Typhoid fever	6	

5 Weeks Ended June 30, 1951

Disease	Cases	Deaths	Disease	Cases	Deaths
Brucellosis	2		Malaria	1	
Diphtheria	10		Meningitis, meningococcal	13	2
Dysentery:			Poliomyelitis	2	
Amebic	8		Scarlet fever	111	
Bacillary	15		Tetanus	5	4
Encephalitis, infectious	2		Tuberculosis (all forms)	199	72
Erysipelas	19	1	Typhoid fever	6	
Food poisoning	11				

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently. A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Cholera

India (French). During the period July 11–20, 1951, nine cases of cholera were reported in the seaport of Pondicherry.

Pakistan. For the week ended July 28, 1951, 14 imported cases of cholera were reported in Chittagong.

Smallpox

India (French). During the period July 11–20, 1951, smallpox was reported in French India as follows: Karikal, 23 cases; Mahe, 2; and Pondicherry, 1.

Indochina. Smallpox was reported for the week ended July 28, 1951, in three ports of Viet Nam as follows: Nam Dinh, nine cases; Haiphong, eight; and Hanoi, three.

Indonesia. For the week ended July 14, 1951, three cases of smallpox were reported in Bandjarmasin, Borneo, and for the week ended July 21, five cases were reported in Surabaya, Java.

Sierra Leone. One case of smallpox was reported in Sierra Leone for the week ended June 23, 1951. This is the first case since the week ended April 14.

Yellow Fever

Cameroon (French). A suspected fatal case of yellow fever was reported in Mora in the Region of Margui-Wandala. This is the first case for this area.

Costa Rica. Three cases of jungle yellow fever have been reported in three separate areas in the Province of Limon which is near the border of Panama. One case was reported on June 2, in Sixaola; one fatal case on July 23, in Trebol, La Estrella; and one fatal case on July 27, in Cayuga, Pococi. This indicates further extension of jungle yellow fever along the Caribbean coastal area from the Republic of Panama.

Gold Coast. During the period July 2–26, nine suspected cases of yellow fever were reported as follows: July 2, one case in Kpandu; July 11, one in Lartch; July 11–12, two in Brenase; July 12, one in the seaport of Winneba; July 15, one in Kpandu; July 18, one in Lartch; July 19, one in Kibi; and July 26, one in Akwatia.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work. Articles of special interest are issued as reprints or as supplements, in which forms they are made available for more economical and general distribution.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price $4.75 a year; $6.25 foreign.

Public Health Reports

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PUBLIC HEALTH SERVICE

FEDERAL SECURITY AGENCY
Oscar R. Ewing, Administrator

PUBLIC HEALTH SERVICE
Leonard A. Scheele, Surgeon General

Division of Public Health Methods
G. St. J. Perrott, Chief of Division

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Public Health Reports

Vol. 66 • AUGUST 31, 1951 • *No. 35*

Conference Report of the Southern Branch of the American Public Health Association

Cooperative efforts in health services . . . heart disease control in a county health department . . . trends in nursing education . . . problems related to fluoridation . . . responsibilities in civil defense . . . sensitivity studies in antibiotic therapy . . . advances in nutrition . . . accidental death statistics . . . fly-borne disease control . . . school lunchroom sanitation . . . next steps in child health and crippled children's programs.

This somewhat random listing suggests the range of topics considered at the twentieth annual meeting of the Southern Branch of the American Public Health Association held at Biloxi, Miss., April 26–28, 1951. On hand were more than 700 public health practitioners—sanitarians, public health nurses, county health officers, clerks, laboratory technicians, entomologists, sanitary engineers, and health educators—from 16 States and the District of Columbia. They met to discuss technical and professional problems in formal sessions and also, through a unique technique—"curbstone consultations"—to discuss common problems informally and individually with experts in specific fields.

The following much-condensed summary of some of the papers presented in the formal sessions was undertaken through the courtesy of L. M. Graves, M. D., M. P. H., director of the Memphis-Shelby County Health Department, Tenn., and newly elected president of the Southern Branch. Many papers could not be included because sufficiently detailed abstracts or texts were not available. It is the custom of the Southern Branch, however, to publish all papers in full in its official proceedings.

Cooperative Efforts in Health Services

An examination of "cooperative efforts of voluntary, official, and professional groups in health services" was undertaken by a panel of seven, led by Felix J. Underwood, M. D., executive officer of the Mississippi State Board of Health.

The Private Practitioner

Ozro T. Woods, M. D., professor of surgery and surgical pathology of the Dallas Medical College, pointed out that "we are all trying to do different parts of the same job . . . we could do a better job of working together." Practitioners of medicine were first trained by the apprentice system, he recalled, learning medicine in its relationship to the community. As the mass of medical knowledge has continually increased, he claimed, we have further isolated the medical student from the community and the other health activities. "We tell him about them and take him visiting to health departments," Dr. Woods noted, "but this academic introduction has failed to create friendship and understanding and cooperation."

"In our enthusiasm," Dr. Woods observed, "we have without intent developed a physician who thinks he is supreme in the health field. He may have learned the value of teamwork with other physicians but, in general, not with others in the health field . . . He seems often not to understand that public health medicine has also made a contribution to the progress in the health of our Nation [and that it] started in areas almost neglected by practitioners."

Dr. Woods went on to point out effects of "exclusiveness" and specialization in terms of separate training facilities, "protective" professional organization, and "special efforts to control some diseases."

"The circumstances which made us this way need to be corrected, and I think it is rather easy to do," Dr. Woods said. "We all enter the health field somewhat alike. We come out different."

The answer, Dr. Woods said, is that "we must grow up together in training. We should all be trained in a common medical center where we learn by working together . . . we would have to work in the community . . . we would stop our isolation from each other and from the community."

"At least after such training each of us would know about the other. I even think we would learn to like each other," he said, continuing: "I think it would be a very satisfying experience to learn better how to apply to sick people all of the health benefits that are known. I think experimentation in this broad field of medical care is as normal as it is in studying individual diseases." Dr. Woods concluded by

saying that "we have not changed our plans of health services to meet the revolutionary advances in medical science."

Community Health Council

Joining with Dr. Woods in discussing the private practitioner's place in the promotion of community health was F. S. Crockett, M. D., of Lafayette, Ind., chairman of the Rural Health Committee of the American Medical Association.

He described the community health council as definitely an educational program, and "a program that is learned through work." It involves two groups: (1) those who supply medical care, and the doctor is the one first thought of; and (2) the consumers of medical care who can be taught many of the rules of healthful living and thereby escape the catastrophe of illness.

"We often speak of 'health' and 'medical care' as though they meant the same thing," Dr. Crockett observed. "This is far from being correct. Better living practices for the maintenance and preservation of health can be taught in varying degrees to everyone and thereby reduce the need for medical care. We should also be able to teach people to get the most benefit from the doctors they have."

When sickness comes it calls for medical care at the hands of some good doctor, he said, pointing out that "medical care cannot be successfully taught to laymen. Consequently, it is not a part of the county health council educational plan." That belongs, he said, to the National and State health councils which have undertaken to interest medical educators and hospital executives to make the modifications and innovations needed to increase the available number of doctors and other personnel, and to provide refresher courses and other postgraduate stimuli for the profession. There is progress in this direction, he reported.

Dr. Crockett reviewed recent work of the Rural Health Committee and developments in health councils. He reported that 43 State medical societies now have rural health committees and that interest in local community health councils is increasing. As an "outstanding example of brilliant accomplishment" he mentioned Clinton County, Ohio.

Clinton County residents wanted to know "facts about the prevalence of certain diseases, sanitary conditions, immunization, and other pertinent information to be obtained simply by asking questions of everyone in the community." The people made the survey themselves, Dr. Crockett emphasized, and it "reached 5,450 families, missed 357 families, and only 98 out of 17,900 persons refused to answer. This was a 2-year effort involving 454 persons.

"Here was a wealthy, complacent, agricultural community apparently quite well satisfied with the way things were going," Dr.

Crockett said. "One would think that, if education and culture would help, here was a county that would show up well on the right side of the health ledger." Among other things "the good people of Clinton County found that they were not affording their children adequate protection from contagious disease or dental caries; that sewage disposal and water supply in both town and country were, in some cases, primitive in character; that the handling of dairy products and the incidence of brucellosis was a very real threat to health."

The report is worth reading, Dr. Crockett said, but cautioned: "In reading it, don't feel sorry for Clinton County—your own home community may not be so good—go home and look it over." Stressing the important values flowing from the voluntary participation of so many people, he said: "It had the value of being an inside job, and the Clinton County Council had excellent support from the local medical profession. It is a good example of the role of the practitioner in the promotion of the health of the community," Dr. Crockett felt.

There is an "increasingly mellow attitude" evident from the recurring conferences of the national Rural Health Committee, he said. "It is an expression of full confidence in the honesty and sincerity of all groups cooperating. We look to its rapid crystallization at the county level in the form of more health councils. We believe the local doctor is in a mood to go along."

"To my mind," Dr. Crockett concluded, "the role of the private practitioner in the promotion of the health of the community is quite clear. He should find his most effective opportunity for teaching health practices in his daily contact with his patients. It is equally important that, in all other efforts to promote community welfare, he should join with his neighbors as a fellow citizen to achieve common goals through community organization."

The Official Health Agency

The organizational form and the character and scope of duties of the public health worker are dependent upon the government of which they are a part, William W. Frye, M. D., dean of the Louisiana State University School of Medicine, reminded the members of the APHA Southern Branch in speaking of the role of official agencies.

He noted great advances in community health protection during the past 25 years and a growing awareness of the responsibilities of the official health agency. "Our responsibilities have increased," he said, "but I am afraid that in many instances the communities have moved ahead in their thinking and planning much more rapidly than our health departments."

"I believe," Dean Frye observed, "one of the biggest factors we have to overcome in the field of health is fear—fear of regimentation and control of individuals. This fear complex is in most instances

based on lack of information, or on an inability of individuals and groups to face the facts and plan for the future."

Turning to the future, Dean Frye said that progress in preventive medicine and public health will be profoundly affected by the broad swing of our concept of health. If the objective continues to be "merely the prevention of specific disease entities, little change in principles and practices can be anticipated," he felt. "If, on the other hand, the official health agency organizes the community to include and integrate all activities intended to improve health, which is always relative in degree, then we can expect progress."

The future strategy of preventive medicine must concentrate attention more and more on the problems of health in the later years of life, without for a moment forgetting youth and middle age, Dean Frye maintained. He noted, as an example, that in contrast to "well baby clinics" the idea of "well adult clinics" is virtually unknown.

"This seems to me," the dean said, "to be an area which the official health agency can no longer ignore. The prevention, retardation, or possible control of the degenerative diseases and chronic illnesses of the population can be accomplished only by such individual action."

The Broadening Concept of Prevention

In a similar vein, John B. Hozier, M. D., of the Public Health Service, Region VI, Atlanta, pointed out that there can be no sharp demarcation between preventive and curative medicine, or between activities or services provided by official and voluntary health agencies.

"There is," Dr. Hozier emphasized, "a whole man to make, or to keep, healthy. There is a community problem we must face and conquer together—the private physician, the voluntary health agency, and the official health agency." Responsibility for coordinating and directing resources of a community toward promotion of community health seems to have fallen logically to the official agency, he said.

This does not minimize, however, the importance of the contributions of all sources toward the promotion of community health, Dr. Hozier emphasized. Historically, groups of citizens—voluntary agencies—have served as spearheads for raising funds to promote specific projects, he said, noting that when the effectiveness of projects has been demonstrated and the need for continuation established, sooner or later some governmental provision is made for continuation and often expansion of the service.

Pointing to the role of private physicians, Dr. Hozier stressed that their "contribution to the over-all health pattern of the community is far-reaching and is accomplished in many ways." As a member of the community which establishes an official health agency, Dr. Hozier noted, the physician "has a part in its creation as well as in the determination of the services which it renders. In his close association with

his patients he has illimitable opportunities, by practicing preventive as well as curative medicine, to improve the health of his community."

The Voluntary Health Agency

In no other country do we find voluntary health and welfare organizations so firmly established and so generously supported by all the people as in the United States, said Hart E. Van Riper, M. D., medical director of the National Foundation for Infantile Paralysis. As these organizations have increased in activity and scope they have interested more and more community leaders in better health for their communities, he said.

"All of us today want to be healthy, and yet when we speak of health, it is a nebulous term that seems difficult to define," Dr. Van Riper said. "Ask the man on the street what he thinks of health, and if he answers at all he will no doubt be confused and bewildered. Ask the same man," Dr. Van Riper continued, "what he knows about cancer, heart disease, tuberculosis, the disaster services of the Red Cross, or poliomyelitis, and his answer will no doubt be largely determined by the activity of these various agencies in his community in the time interval that has existed between the day of the question and the last annual drive of the organization."

Speaking of the voluntary health agencies, Dr. Van Riper said that "there are those today who unknowingly are attempting to destroy this great American institution, not so much the people as the prominent community leaders and industrialists, who are saying that the multiplicity of drives is annoying and disturbing to the people; that we should have but one drive for all voluntary health and welfare agencies. I submit to you," he said, "that we should not have fewer, but rather more, drives, for it is only by constantly bringing before the people the needs of the several agencies that we are able to keep their interest not for one single period in the year but for 52 weeks of the year."

Dr. Van Riper noted that public health workers know "the inability to sell health as a package" and are "more aware than anyone else that we cannot legislate good health, neither can we sell local health units on a county and district basis until the citizens demand such public health units."

The medical director of the National Foundation for Infantile Paralysis concluded by saying that "continued support by the leaders in public health will do much to stimulate, through voluntary activities, the demand for improved health for all of the people."

Public Health and Mobilization

Manpower Reserve Possible Achilles' Heel

The lack of an increasing reservoir of trained, experienced public health personnel may well be the Achilles' heel of the defense effort, Surgeon General Leonard A. Scheele of the Public Health Service warned in a report on the role of public health in defense mobilization. He pointed out:

1. Defense production and build-up of our Armed Forces depend upon the continuous maintenance of health and sanitation services.
2. Improved health in the underprivileged areas of the world is a basic goal of our total mobilization effort.
3. The health and morale of the civilian population at home must be sustained if our basic economic strength is to withstand a long period of mobilization.

"A major factor in the maintenance of civilian welfare for the long pull is the civil defense program," Dr. Scheele stated. "We need to understand better the meaning of civil defense and to contribute fully to its development . . . We must recognize that the planning and development of civil defense, however, is only one segment of the total mobilization program. The emergency nature of civil defense must be distinguished from the present, continuous, and post-disaster responsibilities of the Nation's public health agencies."

The impact of mobilization on public health is already being felt in such matters as the construction of camps and cantonment areas and the creation of whole new communities, the Surgeon General observed. "You know, too, that at the very time these disruptions occur, State and local resources are weakened through loss of trained personnel, shortages of health manpower, and overtaxing of health and sanitation facilities," he said.

"Unfortunately, no national action is being taken to increase our reservoir of trained, experienced public health personnel," Dr. Scheele reported, and "this lack may well be the Achilles' heel of our defense effort." He pointed out that in many parts of our country today, local health resources and manpower are not sufficient to meet a rapidly developing crisis—should it occur. In other instances, local health services are completely lacking or are so poorly developed that the communities could not cope with the evacuees and other effects of enemy attack on outlying areas.

Must Improve Quality of Services

"Although the strengthening and extension of local health services has long been a common goal, the Nation is no nearer that goal than

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it was 3 years ago," Dr. Scheele warned. "Unless we move forward quickly now, the Nation's health services may be found at the peak of mobilization to be too little and too late. The quality of our health services must be improved if we are to achieve the goals of mobilization. Manpower is the most critical commodity in the national economy today—and we must conserve it, so that every man and woman can make a full contribution to the mobilization effort.

"This improvement depends primarily upon the effectiveness with which we utilize our resources," he continued. "We can do better than we have been doing, and I believe that mobilization can and will hasten our understanding that we are living in a new age—an age that is supplying public health with new knowledge, new techniques, equipment, and drugs, and is supplying us also with new opportunities to work out better methods of organization and management by which to utilize our health resources to the best advantage.

"Clearly," the Surgeon General said, "we must now gear our public health programs to the new technologies. Yet very few of our existing health programs are geared to the imminent future. For example, there can no longer be excuses for setting the professionally trained nurse to tasks commonly performed by less highly trained employees. There are many other categories of trained personnel who, because of outmoded methods of administration and practices, are unable to make full contribution to the health of the people. The trained health educator, for example, has much to offer—not only in educational activities with the public but also in the organization and operation of staff education programs." Dr. Scheele pointed out that many health services, hospitals, and research projects "suffer from ineffective record-keeping and from failure to utilize the health statistician for accurate analysis and evaluation of program."

The People Are Out in Front

Dr. Scheele emphasized that "we are not utilizing fully many techniques which were shown to be effective years ago, for we in public health are sometimes a little too complacent about what we call 'cultural lag.' Today, in many parts of the country, it is we who are lagging—the people are out in front of their health services, demanding action programs in many fields and better organization of hospital and medical services."

By way of illustration the Surgeon General noted that "although the control of epidemics is a basic function of public health, nevertheless we have failed to develop and modernize one of our most effective tools—the epidemiologic team. Success in the control of many epidemic diseases has encouraged us to neglect this technique; yet, not many decades ago, epidemiologic investigation of an outbreak was routine. We must now rebuild our epidemiologic services—

not only for effective control of disease now but also for defense against biological warfare. More precise, more rapid systems of disease reporting also are needed, and progress is being made in this direction.

"It is imperative that we improve our public health laboratories in order to effectively back up our epidemiologic services," Dr. Scheele declared. Also "the streamlining and reorientation of our industrial hygiene program is a must, for the defense production program of the next few years will impose enormous and often bewildering tasks upon industrial health services and one of our first steps will attempt to place the new industrial toxicology on a sound physiological basis." He went on to point out that "Health agencies must develop cooperative activities with Federal, State, and local rehabilitation programs in order that defense industry may make the most effective use of rehabilitated workers—and that more disabled men and women may be brought to treatment and restored to productive life.

"We have barely made a start on chronic disease control," Dr. Scheele stated. "There must be rapid, well-planned development and a strong effort to stem the tide of chronic disease, or the drain on productive manpower imposed by these major killers and cripplers will indeed seriously maim our national defense. More research and sound community programs must be started to mobilize public and private resources for the prevention, early detection, diagnosis, and treatment of chronic disease.

"The core of the matter, however, is that health services and increased health manpower are essential in all phases of mobilization," the Surgeon General concluded. "Eventually, the Nation will have to recognize that these health manpower shortages are national in scope and high in priority."

Health of the Hemisphere

The United States can be extremely helpful in furthering the orderly expansion of public health programs in the Americas by supplying trained technicians and the necessary tools, John R. Murdock, M.D., assistant director of the Pan American Sanitary Bureau, Regional Office of the World Health Organization, stated in describing recent health program activities on the two American continents.

The continent-wide effort against insect-borne diseases faces a shortage of DDT and chlorine-based insecticides which the United States could help to meet, he said. Twenty-eight countries and territories in the Americas are now engaged in a battle against a common foe, the *Aedes aegypti* mosquito, he reported.

By the end of 1950, he stated, 230,670 communities had been inspected in this campaign, nearly half of them during the year. Bolivia is free of *A. aegypti*, and Brazil, Uruguay, Paraguay, and Panama are in the last stages of the work. The United States, how-

ever, needs to intensify its campaign against this mosquito, he said, since it still "abounds in southern towns and cities." In many countries the campaign against *A. aegypti* is merging into expanded programs against malaria, Chagas disease, typhus, plague, and other diseases.

Dr. Murdock reported considerable expansion of activity in rabies, hydatidosis, and brucellosis control. Demonstration programs in tuberculosis control are operating in El Salvador, and are to be instituted in Ecuador, Jamaica, and Paraguay. Mass BCG programs are operating in Mexico and Ecuador. A training scheme established by Ecuador enables doctors and nurses to carry out the programs in their own countries, he reported. The Uruguay BCG laboratory is to be converted into an international BCG production and supply center.

A similar increase in activity and progress was reported in venereal disease, smallpox, and other communicable disease programs. The lessons learned at the Institute of Nutrition of Central America and Panama at Guatemala City may well point the way to practical methods of raising nutritional standards in like climatic belts throughout the world, he said.

Dr. Murdock described the first project of the Point IV technical assistance program—the establishment of a health demonstration area in El Salvador—which embraces work in the fields of health, agriculture, labor, and education. Adjacent countries may send observers and persons for training during any stage of the program, which includes all aspects of public health.

Selected Reports

Cautions Care in Antirabic Vaccine Use

T. F. Sellers, M. D., director of the Georgia Department of Public Health, warned that antirabic vaccine is not harmless and that there is considerable danger of inducing treatment paralysis.

During the past few years mortality from rabies has declined but antirabic sensitization deaths and serious complications have increased to the point where physicians must now realize that antirabic vaccine should not be administered indiscriminately, he stated.

Two concepts have emerged from the research of the past few years. First, rabies is communicable only by direct bite into the flesh deep enough to touch nerve tissue and, second, antirabic vaccine prepared from brain tissue, if repeatedly injected over a long period of time, may induce specific brain tissue sensitization, sometimes causing treatment paralysis, a serious and often fatal complication, Dr. Sellers reported.

Standards for considering the animal as potentially infectious were outlined by Dr. Sellers as follows:

1. The animal is clincially rabid, even though post-mortem brain examination fails to reveal Negri bodies.
2. Clinical behavior before death was not rabid, but brain shows Negri bodies.
3. If the animal is not available for examination.
4. Any animal that bites without provocation and is immediately killed should be suspected even if laboratory findings are negative.

Antirabic treatment is indicated, Dr. Sellers stated when:

1. Wounds have penetrated the skin.
2. Wounds were inflicted through clothing torn by the animal's teeth.
3. It is suspected that the saliva contacted fresh, open, or raw preexistent abrasions.
4. When the exposed person is too young to give reliable testimony.

Antirabic treatment is contraindicated, he said:

1. When there is no broken skin anywhere on the body, including face or mouth.
2. If previous wounds are known to be over 24-hours old or are covered with an unbroken scab.
3. If the tooth wounds were made through untorn clothing—such wounds are usually bruises.

4. If exposure is limited to handling only the dog or objects contaminated with the saliva, or to drinking the milk of rabid cows or goats.

5. If the wounds were inflicted not less than 7 days prior to the detection of visible signs of the disease.

6. If the animal remains normal for as long as 7 days after inflicting the wounds.

Reimmunization should be avoided for borderline exposures regardless of the time elapsed since the last treatment, Dr. Sellers stated. Retreatment should be limited in any case to a short booster series of five or six injections.

Dysentery Reduced by Fly Control

In 1941, reports of isolations of poliomyelitis virus from nonbiting flies collected during epidemics stimulated public interest in flies as disease carriers. Dale R. Lindsay, Ph. D., of the Communicable Disease Center, Public Health Service, reporting on progress in the control of fly-borne diseases, said this interest was dampened by World War II and the fact that epidemics are unsatisfactory for testing the effects of fly control upon the prevalence rates of the disease.

A much better disease for such testing, Dr. Lindsay continued, was bacillary dysentery which in certain areas occurred endemically with high prevalence rates associated with seasons of fly abundance. Hence, two such areas, the Rio Grande Valley in Texas and certain communities in southwest Georgia, widely divergent in other respects, were chosen for the fly control program. A significant reduction in reported dysentery prevalence rates resulted, confirmed by an even more marked reduction in the numbers of positive *Shigella* infections as revealed by rectal swab cultures from children under 10 years of age.

The Rio Grande Valley experiment, completed in 1948, constituted the first field proof of the common, nonbiting flies as vectors of disease. These experiments were made possible through the existence of efficient residual type insecticides, which for a short time were believed to be the solution for the problem of fly control. At present, Dr. Lindsay said, the common housefly is found to be resistant to some degree to DDT, and to other insecticides as well, in nearly every community where such insecticides have been used.

Dr. Lindsay discussed other possibilities of fly control such as additions of the effective portion of metabolic end products to otherwise favorable breeding media, which, he says, would probably not harm the fertilizer value of animal excrement, for instance, and should not be toxic to vertebrates.

Since development of resistance to insecticides appears inevitable, only prevention of fly breeding by sanitary measures remains as a recommended procedure, he felt.

Sanitation Stressed in Fly Control

F. Earle Lyman, Ph. D., and George Bradley, Ph. D., also of the Communicable Disease Center, agreed with Dr. Lindsay, emphasizing that general sanitation is still the best method known for attaining adequate and permanent fly control. They stated that although it has been shown that sprayed houses do have less flies than unsprayed houses, the degree of fly control being achieved is not as high as is desired. However, they thought that present evidence indicates that lack of satisfactory control is not due in any large extent to resistant houseflies. It is more, they said, a result of an accumulation of numerous factors—an important one of which is the inability to kill enough flies in the face of extensive breeding potentials resulting in large fly populations. Residual sprays are temporary at best and are used to attack the problem after it is allowed to occur rather than to prevent the problem at the start. Prevention, they said, is a fundamental concept in all public health work.

Real Maternal and Child Health Progress

Tremendous improvement has been made in maternal and child health in the past 15 years, Edwin F. Daily, M. D., director of the Division of Health Services, Children's Bureau, reported. Maternal mortality has decreased more than 80 percent and infant mortality, nearly 45 percent. More than 85 percent of deliveries now take place in hospitals compared with less than half of them 15 years ago. Parents know much more about child health, and communicable diseases are far less serious, he said.

Citing the discovery of antibiotic drugs, use of fluorides to prevent tooth decay, new ways of treating poliomyelitis patients, and new methods for detection and treatment of hearing loss in children as among the important scientific contributions to child health, he named as the most important our realization of the part emotions play in determining the outcome of illness, pregnancy, or physical handicap.

"We know now that understanding the feelings and attitudes of people is as essential as providing immunization, diagnosis, or treatment," Dr. Daily said. In the trend toward "humanizing" hospital care for both mothers and children, more attention is given to their wishes and requests, he explained. And more attention is paid to the emotional, recreational, and educational needs of children hospitalized for long periods.

Dr. Daily stressed the need for the aid of citizen and parent groups in helping plan and apply expanded health services for mothers and children. This year, the combined Federal maternal and child health and crippled children's fund and required State matching funds are $34,762,500, more than three times the amount allotted 15 years ago.

Although the Congress and the States recognize the needs of mater-

nal and child health to this extent, no program in a community can last without active citizen cooperation, he pointed out. Each community, calling upon professional guidance, must know what can be accomplished and what is most desirable. Each community must decide what health services will most benefit their children and mothers.

Louisiana Program for Premature Infants

Louisiana's five-point program initiated in 1945 to reduce the premature infant death rate has progressed considerably, according to S. J. Phillips, M. D., president of the State Board of Health and State health officer of Louisiana.

Prematurity—the leading cause of infant deaths in Louisiana—accounts for approximately 30 percent of all infant deaths annually, he said. A similar situation exists in other areas of the United States, particularly in the South, Dr. Phillips stated.

The five phases of the program, designed to train graduate nurses in premature infant care and supply facilities, were outlined by Dr. Phillips:

1. Establishment of a training center in premature infant care in the New Orleans Charity Hospital.
2. Establishment and staffing of premature infant care centers in outlying charity hospitals of the State.
3. Investigation of the home and provision for follow-up care.
4. Placement of incubators, loan kits, and carrying cases for premature infants in all parish health units.
5. Provision of hospital nursing consultation.

The greatest advances have been made in establishing the training program at New Orleans and in follow-up care, Dr. Phillips said. The training center entailed cooperative planning by the hospital, the pediatric staff of the medical schools of the Tulane and Louisiana State Universities, and the State Department of Health with the Children's Bureau of the Federal Security Agency.

Fourteen 6-week classes have been held and 102 nurses have received instruction and clinical training at the center since April 1949. Resident physicians receive training through work in the premature unit for two 2-month periods.

Follow-up care, consisting of three home visits by a public health nurse, is provided for both New Orleans and the outlying parishes, Dr. Phillips reported. Twice before the baby's discharge from the hospital, the nurse evaluates the facilities in the home. She makes the third visit after the baby's discharge to ascertain its progress and to help with any difficulties. Cases involving social problems are referred to the local welfare department, which also makes the home evaluation in parishes without health units.

Availability of incubators, loan kits, and carrying cases in the local health units has been vitally important in saving lives, he declared. And the hospital nursing consultant, whose advisory services on the care of newborn infants and their mothers are now available to all hospitals in the State, will stimulate hospitals to set up separate nurseries for premature infants, he believes.

Dr. Phillips hoped that work will begin soon on the premature infant care centers planned for seven outlying charity hospitals, to be staffed with personnel trained in the New Orleans hospital. Facilities would thus be brought within 90 miles of the home of any premature infant born in the State, he said.

Perspective on Rat Control

David E. Davis, Ph. D., of the Johns Hopkins School of Hygiene and Public Health, compared rat control with the whole field of wildlife management and found little difference in the principles involved. Every species, he said in speaking of a perspective on rat control, is regulated in its abundance by a variety of factors. These can be grouped under three heads: (1) environment, (2) depredation, and (3) competition.

Environment produces a mortality that is independent of the density of population. In contrast, depredation and competition produce mortality that increases proportionately to that density. Rat control, therefore, becomes a problem of intensity of action. In terms of cost, the increase of depredation rarely can be adequate, within the budgets available, to satisfy health requirements. An increase in mortality by changing the environment reduces reproduction and increases depredation. In addition, this change improves living conditions for people.

A comparison of the history of changes in rat population in Baltimore, Dr. Davis continued, shows that poisoning gives only temporary relief, but that human housing rehabilitation results in a permanent reduction of the rat population.

Ratproofing Best Method

That rat poisoning seems to increase rather than decrease typhus in rats while ratproofing sanitation acts to reduce it was the conclusion reached by N. E. Good, Ph. D., J. H. Schubert, Ph. D., and C. O. Mohr, Ph. D., of the PHS Communicable Disease Center.

There has been a very satisfying and steady reduction in the number of human cases of murine typhus in the United States during the past 6 years, but a continued decrease, they said, must be based on reduction of typhus infection in domestic rats rather than on the control of the principal vector, *Xenopsylla cheopis,* alone. DDT dusting is effective on *X. cheopis* but not against certain other rat ectoparasites.

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In order to plan effective measures for reducing typhus in rats, it is necessary to know the basic factors which determine prevalence. These are classified under the three general heads: (1) environment, (2) the rat, and (3) artificial or introduced factors. The latter factors relate to the control by man of either rats or of the arthropod vectors of murine typhus.

Typhus Morbidity Reappraisal

Considerable evidence is available from areas of moderate to high endemicity for murine typhus that the disease has been under-reported, according to Griffith E. Quinby, M. D., M. P. H., of the PHS Communicable Disease Center Epidemiologic Service. Some studies, he noted, lacked complement fixation confirmation data and therefore are open to some question as to the degree of under-reporting.

During 1949 and 1950, 335 reported or reputed cases of typhus were appraised in five Southern States, Dr. Quinby said. Of these, 116, or 35 percent, were confirmed by complement fixation tests as positive cases of typhus, but at least 20 percent were appraised as other than typhus. This indicated that some degree of over-reporting exists, particularly in areas where typhus occurs sporadically, he stated. Many other cases in the presumptive, doubtful, and incomplete categories could be expected to increase this percentage.

The determination of the degree to which areas of under-reporting will balance those of over-reporting must await more intensive and extensive communicable disease appraisal, he said. If typhus continues its present decline in prevalence, relatively more over-reporting may be anticipated, Dr. Quinby stated.

Low Point for Malaria

In a review of malaria in the United States, Justin M. Andrews, D. Sc., deputy officer in charge, PHS Communicable Disease Center, stated that all malariometric evidence indicates that the present prevalence of the disease is the lowest recorded. Reported malaria deaths and cases have diminished continuously since the last epidemic wave in the mid-thirties, he reported. During the last 18 years the annual proportion of positive blood smears among some 3 million diagnostic and survey slides have decreased markedly.

Probably the strongest testimony at hand for the conclusion that malaria transmission has ceased entirely or is maintained only at low levels in isolated areas comes from the systematic epidemiologic appraisal of cases, he stated. In 1949 and 1950, 19 and 7 cases, respectively, were considered to be indigenous primary malaria. Thus, on the basis of reported malaria statistics of the results of routine diagnostic and survey blood examinations and the paucity of actual primary indigenous cases, it is contended that endemic

malaria has declined to a very low level and is probably approaching the vanishing point.

The national malaria eradication program was launched 4 years ago as a continuation of the extended malaria program established after World War II to prevent introduction of foreign malarias to this country by infected repatriated service men, Dr. Andrews said. DDT, as a residual spray, was applied on the interior surfaces of homes and privies where relatively high malaria prevalence had been reported. These operations were reinforced by supplementing the staffs of State health departments with Federal epidemiologic personnel to assist in the investigation of reported deaths and cases allegedly caused by malaria and to consult with physicians concerning diagnosis and treatment.

County Health Department Heart Program

A challenge that no county health department can afford to ignore is the fact that 9 million people in the United States have heart disease, stated Leon Banov, M. D., health officer of Charleston, S. C. As the life span increases, we may expect cardiovascular disease to take more lives, he said.

A significant beginning to the Nation-wide campaign against heart disease, the leading cause of death today, can be seen in the creation of the National Heart Institute, the heart section in the Division of Chronic Disease and Tuberculosis of the Public Health Service, and the recent expansion of the American Heart Association, Dr. Banov stated.

Charleston, S. C., following the lead of Newton, Mass., has established a heart disease prevention demonstration pilot study, financed largely by the Public Health Service, to evaluate and use various methods and techniques of heart disease prevention at the county health department level, Dr. Banov said.

He listed as present objectives: to find the early, unknown, and potential cardiac cases and send them for medical care; to provide social, nutritional, and related services to doctors for patients; to aid in rehabilitation of patients with the help of social and welfare agencies; and to develop effective programs for preventing heart disease as far as present knowledge permits.

Mosquitoes and Encephalomyelitis

Evidence, though slight, was found by Thomas A. Cockburn, M. D., D. P. H., Communicable Disease Center, to support the theory that mosquitoes initially acquire the encephalomyelitis virus by feeding on birds with viraemia. In a study of encephalitis in the Missouri River Basin, he summarized his conclusions thus:

1. Western equine encephalomyelitis was isolated six times from birds and arthropods collected in the field.

2. Three of these isolations were from nestling birds and preceded the isolations from mosquitoes by nearly 2 weeks.

3. There was only one human case and no equine case in the area.

4. It was concluded that this indicated a persistence of inapparent infection between epidemics, and also supported the assumption that the mosquitoes acquire their infection from birds.

Dr. Cockburn, however, warned that similar isolations must be repeated many times before they can be considered significant.

Mosquito Data for Missouri Basin

The density and distribution data now available on mosquitoes from the 10 Missouri River Basin States were summarized by Gordon E. Smith, Ph. D., John A. Rowe, Ph. D., and George R. Schultz, B. S., Communicable Disease Center, Public Health Service.

Records charted from 549 counties throughout the Missouri Basin showed the presence of 82 mosquito species.

Density data, obtained from mosquito light-trap records from 147 traps operated for 11,178 nights in 96 counties, were presented in detailed tabular form for 7 of the more important species while both the density and the distribution of 23 species were indicated on individual maps. Two species, *Aedes vexans* and *Culex tarsalis* accounted for 64 percent of the total catch. No attempt was made in the study to correlate these data with the various ecological factors of the region, but several new records were established and the range of many new species were clarified.

Mosquito Breeding Areas

Inadequate disposal of waste water from irrigated lands, application of water to land which has not been properly prepared for irrigation, seepage of ground water from higher land, and inadequate maintenance of irrigation distribution systems were conditions found by Marshal B. Rainey, B. S., and a team of scientists from the PHS Communicable Disease Center, to be responsible for mosquito breeding in two areas in Nebraska in 1950. Although factors responsible for mosquito breeding on areas of these types are now well defined, additional studies, the scientists believed, will be necessary in order to define them on other types of irrigation developments where soil, crops, and irrigation practices may be different from those in the areas already studied.

In another study of four dry-farm areas along the Republican River in Nebraska and Kansas in 1949, George C. Keener, M. S., John A. Rowe, Ph. D., and Gordon E. Smith, Ph. D., PHS Communicable Disease Center, presented in graphic form the seasonal summary for each plot showing (1) daily precipitation, (2) total watered area and actual breeding area, (3) average number of larvae

per dip, (4) species identified from larval samples, and (5) mosquito breeding index for the plot. Twenty-seven mosquito species were represented in the total collection for the season with four species (*Aedes vexans*, 31 percent; *Culex tarsalis*, 31 percent; *Aedes nigromaculis*, 15 percent; and *Proprophora signipennis*, 4 percent) accounting for 81 percent of the total. The two principal types of mosquito breeding places on all plots were roadside ditches and surface pools, the investigators said.

Florida Epilepsy Program

Florida is combating epilepsy through the coordinated services of all State and private agencies, according to Frances E. M. Read, M. D., director of the Florida epilepsy program.

Institutes on epilepsy meet throughout the State, she reported. One institute was timed to coincide with a meeting of the Florida Education Association so that teachers could enter into the program, she said.

During 1950, Florida purchased four new electroencephalographs. The information from the EEG's is supplied to physicians to aid them to determine treatment for any given case. In 1950, 268 encephalograms were taken at Miami, an increase of 117 over the preceding year. Of this number, 54 were diagnosed as epileptic and 21 showed cerebral damage, Dr. Read reported.

"The educational institutes sponsored by all the departments vitally concerned with the many phases of epilepsy is a new venture in public health," she said. Several States have requested information concerning the organization. Maryland and Texas are planning similar institutes during the coming year.

Improved Mortality Statistics

The Sixth Revision of the International Classification of Causes of Death provides for improved analysis of mortality statistics, and a great advance in the accuracy of mortality statistics should be seen in the next few years, according to W. Thurber Fales, D. Sc., director of the statistical section of the Baltimore City Health Department.

The increased number of categories, however, present many problems, Dr. Fales said. States will not be expected to publish according to the detailed list. The National Office of Vital Statistics, Public Health Service, has prepared 4 lists of selected causes of death; 1 of 250 causes, 1 of 64, another of 32, and 1 of 45 selected causes of infant deaths. These lists can serve as guides to State and local health departments.

At the same time the Sixth Revision was adopted, the international medical death certificate was adopted for inclusion on the standard State death certificate, he stated. NOVS recently issued a film on the

principles of correct medical certification, an area of possible weakness in mortality reporting.

Time series of death rates based on the Fifth Revision require a bridge for comparability with the new revision, particularly where diabetes and nephritis are concerned. NOVS has issued a report on comparability ratios which will help bridge the gap, Dr. Fales said.

Nurse Education

A Commission on Nursing Education appointed by the Board of Control for Southern Regional Education is expected to complete and report its study this fall, W. J. McGlothlin, associate director of the Board of Control, stated.

The Board, formed in 1949, is composed of governors and educators from 13 Southern States. It assists States, institutions, and agencies concerned with higher education to advance knowledge and improve the social and economic level of the South. The Board operates under the State legislatures which support it, he said.

Although a previous nursing study had been made (recommending arrangements to help develop graduate programs leading to a master's or higher degree in nursing), the Board was unable to follow through because of the urgency of problems in other fields, he stated.

Interstate contracts are made for medical, dental, and veterinary students. During 1950–51, nearly 600 students were being trained under contracts. The Board is considering the inclusion in the program of other graduate fields.

In another talk, Olwen Davies, R. N., Associate Director of Education, National Organization for Public Health Nursing, discussed the general trends in nursing education in the United States.

A progress report was given on the development of the first university school of nursing in Mississippi which has 15 students at present. Scholarships provided through the State legislature have been used to improve preparation of faculty members for State schools.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended August 11, 1951

Poliomyelitis

The 1,522 poliomyelitis cases reported for the current week represent an increase of 26 percent over the 1,203 cases for the week ended August 4. Two-thirds of this increase over the previous week is accounted for by sizable increases in the East North Central and Mountain States. In the West North Central and South Atlantic States there was only a slight increase over the previous week, and in the West South Central and Pacific States there was a slight decrease in cases reported.

Since the seasonal low week, 7,152 cases have been reported in the United States, as compared with 7,602 for the same period in 1950, and 12,958 in 1949. The cumulative total for the calendar year is 8,364. For the corresponding periods of 1950 and 1949, the totals were 8,733 and 13,871, respectively.

In New York State, where 105 cases were reported for the current week, 37 occurred in New York City. Cases have not been reported in large numbers in other parts of the State. In Illinois, where the number of cases reported last week was 81 and 129 for the current week, more than half have occurred in Cook and Champaign Counties. For the current week, 37 cases were reported in Chicago. In Michigan, one-half of the cases have been in Detroit and other urban sections of Wayne County. Only 2 other counties, Macomb and Oakland, have reported more than 5 cases in any week prior to the current week for which data are not yet available for individual counties. In Wisconsin, more than one-half of the cases in the State continue to be reported from Milwaukee. A total of 34 cases was reported in Milwaukee for the week ended August 11.

Information has been received from the National Foundation for Infantile Paralysis that 11 Indians living near Hayward, Sawyer County, Wis., have been hospitalized with poliomyelitis in Duluth. The Bureau of Indian Affairs states that this outbreak has been under investigation by their medical officers since August 7.

In Tennessee, where there has been an increase in incidence in recent weeks, only a few areas have been involved—Shelby and Tipton Counties in the southwestern part of the State; while in the central part, Davidson, Hickman, Maury, and Rutherford Counties have accounted for most of the cases. In Alabama, a large proportion of the cases have occurred in Jefferson and Mobile Counties. In Mississippi, where several counties in the west central part of the State have reported a relatively high incidence, the peak has been reached according to latest reports. In Colorado, poliomyelitis incidence has been highest in Pueblo County and in the Denver area. Salt Lake and Utah Counties have reported most of the cases in the State of Utah.

Epidemiological Reports

Anthrax

Dr. Emil Kotcher, Kentucky Department of Health, reports the occurrence of one case of anthrax in a man who lives and works in an area where an epizootic has been in progress among domestic animals. He was working on a delta plantation in Fulton County and was bitten by an insect while examining an animal dead of anthrax. Dr. R. H. Hutcheson, Tennessee Department of Health, reported another case in a resident of Hickman, Ky., who was hospitalized in Memphis. This patient had been vaccinating cattle against anthrax for 2 or 3 weeks prior to his illness.

In addition to the area comprising 2 counties in southwestern Kentucky and 2 in northwestern Tennessee, anthrax has been reported recently in 3 other States, according to reports received by the Department of Agriculture. In Lyons County, Nev., 41 cattle on 15 ranches died of anthrax in recent weeks. Eighteen head of swine on 8 different premises were also lost in Nevada. Spread of infection by biting flies among the swine was suspected. Anthrax was reported to be occurring in Morton and Richland Counties, N. Dak., but no details are available. An outbreak in swine has been reported in New Jersey, and in a packing house 1 steer was found to be infected.

Gastroenteritis

Dr. A. M. Washburn, Arkansas State Board of Health, states that a local physician reported that epidemics of gastroenteritis and septic sore throat had occurred in the area where he practiced during the latter part of July. The gastroenteritis occurred chiefly among children from 6 months to 10 years of age and was characterized by by rapid onset with high fever and severe abdominal cramps. Myalgia, headache, and peripheral muscle cramps occurred in many cases. Recovery in 48 hours was usual. Stool cultures did not reveal positive evidence of an etiological agent.

H. C. Clare, Idaho Department of Public Health, has reported three cases of gastroenteritis which occurred after eating soft ice cream from an ice cream stand in Twin Falls. Investigation showed that there were faulty procedures in cleaning the ice cream making machine and in the handling of the mix whereby flies and other contaminants came in contact with the materials. Both coliform organisms and staphylococci were found in the machine and the unused mix.

Whooping Cough

Dr. L. L. Parks, Florida State Board of Health, reports that whooping cough has been much more prevalent in 1951 than it was in 1950. During the first 6 months of 1951, 609 cases with 14 deaths were reported as compared with 471 cases and 7 deaths for all of 1950. More than twice as many deaths have occurred from whooping cough (14) this year as compared with poliomyelitis (6).

Malaria

The Arkansas Board of Health has received additional reports of malaria in military personnel who had been in service in Korea. Up to August 4, 104 cases have been verified by laboratory examination. It was previously reported that 79 cases had been diagnosed between May 15 and July 22. The majority have been recognized at the military establishments in Arkansas, but in several instances the diagnosis has been established by private physicians.

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Aug. 11, 1951	Aug. 12, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	-------	-------	-------	(1)	(1)	(1)	(1)	44	29	32
Diphtheria (055)	52	83	137	27th	227	322	577	2,235	3,450	5,187
Encephalitis, acute infectious (082)	28	23	23	(1)	(1)	(1)	(1)	[2] 609	495	361
Influenza (480–483)	232	331	331	30th	482	770	616	116,537	139,534	139,534
Measles (085)	1,957	1,305	1,305	35th	[3] 494,051	304,795	582,899	[3] 465,350	285,665	547,953
Meningitis, meningococcal (057.0)	38	41	45	37th	3,777	3,497	3,399	2,816	2,584	2,427
Pneumonia (490–493)	451	639	(4)	(1)	(1)	(1)	(1)	45,605	59,981	(4)
Poliomyelitis, acute (080)	1,522	1,435	1,435	11th	[5] 7,152	7,602	7,602	[5] 8,364	8,733	8,430
Rocky Mountain spotted fever (104)	14	23	29	(1)	(1)	(1)	(1)	233	322	382
Scarlet fever (050) [6]	255	257	350	32d	[7] 69,077	56,609	80,210	[7] 53,386	40,170	57,666
Smallpox (084)	-------	-------	1	35th	17	44	70	9	24	49
Tularemia (059)	12	19	22	(1)	(1)	(1)	(1)	428	631	641
Typhoid and paratyphoid fever (040, 041) [8]	84	105	138	11th	1,139	1,502	1,629	1,574	2,012	2,114
Whooping cough (056)	1,167	2,250	2,183	39th	68,307	105,588	88,432	46,705	84,052	62,414

[1] Not computed. [2] Deduction: North Carolina, week ended June 16, 1 case. [3] Addition: Wisconsin, week ended June 30, 1248 cases. [4] Data not available. [5] Deduction: North Carolina, week ended July 14, 1 case. [6] Including cases reported as streptococcal sore throat. [7] Addition: Wisconsin, week ended August 4, 10 cases. [8] Including cases reported as salmonellosis.

Reported Cases of Selected Communicable Diseases: United States, Week Ended August 11, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	52	28	232	1,957	38	451	1,522
New England	2		2	195		19	62
Maine			2	35		7	5
New Hampshire				9			5
Vermont				14			1
Massachusetts	2			116			26
Rhode Island				6			
Connecticut				15		12	25
Middle Atlantic	4	11		566	1	52	140
New York	2	11	(1)	327			105
New Jersey	2			102	1	16	10
Pennsylvania				137		36	25
East North Central	5	7		447	5	47	390
Ohio	2			68	1		73
Indiana	1			10	1	2	16
Illinois	1	3		122	1	23	129
Michigan	1	4		49	1	22	115
Wisconsin				198	1		57
West North Central	4	1	1	78	5	38	138
Minnesota	3		1	18	1	11	19
Iowa	1			6	1		33
Missouri				13	1		26
North Dakota				25		26	2
South Dakota				2			3
Nebraska				6	1		25
Kansas		1		8	1	1	30
South Atlantic	11	1	63	167	9	44	121
Delaware				1			
Maryland	2		1	100		18	7
District of Columbia				6		7	3
Virginia	2		56	33		9	18
West Virginia	3	1		2	1		12
North Carolina	2			5	3		16
South Carolina	1					3	7
Georgia	1		6	10		7	38
Florida				10	5		20
East South Central	11	1		63	10	23	167
Kentucky	4			41	2		17
Tennessee	2	1		11	5		51
Alabama	2			8	1	14	71
Mississippi	3			3	2	9	28
West South Central	10	4	71	125	4	164	200
Arkansas			24	2		20	18
Louisiana	1		1	5		52	36
Oklahoma			46	5		12	49
Texas	9	4		113	4	80	97
Mountain	3		77	93		41	180
Montana	3		15	27			1
Idaho				14			5
Wyoming				4			3
Colorado			3	8		5	112
New Mexico				11		29	3
Arizona			59	9		7	20
Utah				20			34
Nevada							2
Pacific	2	3	18	223	4	23	124
Washington			7	25	1		19
Oregon			4	33		4	16
California	2	3	7	165	3	19	89
Alaska							1
Hawaii				55			3

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended August 11, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040,041)	Whooping cough (056)	Rabies in animals
United States	14	255	---	12	84	1,167	123
New England	---	18	---	---	---	59	---
Maine	---	3	---	---	---	11	---
New Hampshire	---	7	---	---	---	6	---
Vermont	---	---	---	---	---	2	---
Massachusetts	---	4	---	---	---	36	---
Rhode Island	---	1	---	---	---	---	---
Connecticut	---	3	---	---	---	4	---
Middle Atlantic	1	46	---	---	5	140	14
New York	---	31	---	---	1	46	4
New Jersey	---	3	---	---	1	52	---
Pennsylvania	1	12	---	---	3	42	10
East North Central	---	49	---	---	4	226	18
Ohio	---	16	---	---	2	34	2
Indiana	---	3	---	---	---	18	10
Illinois	---	8	---	---	2	37	---
Michigan	---	16	---	---	---	64	6
Wisconsin	---	6	---	---	---	73	---
West North Central	---	15	---	2	5	56	22
Minnesota	---	4	---	---	---	6	4
Iowa	---	3	---	---	2	19	7
Missouri	---	4	---	2	2	19	1
North Dakota	---	---	---	---	---	1	---
South Dakota	---	1	---	---	---	3	---
Nebraska	---	1	---	---	---	3	1
Kansas	---	2	---	---	1	5	9
South Atlantic	8	27	---	7	17	143	16
Delaware	---	---	---	---	---	1	---
Maryland	2	2	---	---	2	10	---
District of Columbia	---	3	---	---	---	10	---
Virginia	3	5	---	1	2	22	7
West Virginia	---	1	---	---	---	43	3
North Carolina	2	11	---	2	2	36	---
South Carolina	1	---	---	1	3	8	4
Georgia	---	2	---	3	7	6	2
Florida	---	3	---	---	1	7	---
East South Central	3	21	---	1	10	124	22
Kentucky	---	7	---	---	5	70	15
Tennessee	1	9	---	---	---	32	4
Alabama	1	4	---	---	1	16	---
Mississippi	1	1	---	1	4	6	3
West South Central	1	21	---	---	19	265	31
Arkansas	---	7	---	---	1	34	2
Louisiana	---	1	---	---	1	3	---
Oklahoma	1	3	---	---	2	22	2
Texas	---	10	---	---	15	206	27
Mountain	1	8	---	1	6	68	---
Montana	---	1	---	---	1	---	---
Idaho	---	1	---	---	2	12	---
Wyoming	---	---	---	1	---	2	---
Colorado	---	---	---	---	1	15	---
New Mexico	---	1	---	---	---	11	---
Arizona	---	1	---	---	2	25	---
Utah	1	4	---	---	---	3	---
Nevada	---	---	---	---	---	---	---
Pacific	---	50	---	1	18	86	---
Washington	---	1	---	---	1	18	---
Oregon	---	1	---	---	---	4	---
California	---	48	---	1	17	64	---
Alaska	---	---	---	---	---	---	---
Hawaii	---	---	---	---	---	---	---

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended July 28, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	5	----	----	----	----	2	2	----	----	----	1
Chickenpox	434	2	----	11	1	23	193	33	16	89	66
Diphtheria	3	----	----	----	----	3	----	----	----	----	----
Dysentery, bacillary	18	----	----	----	----	3	2	----	----	----	13
Encephalitis, infectious	1	----	----	----	----	----	1	----	----	----	----
German measles	103	----	----	----	----	27	36	3	8	19	10
Influenza	17	----	----	10	----	----	3	----	----	----	4
Measles	479	16	----	41	2	85	99	23	6	134	73
Meningitis, meningococcal	2	----	----	----	----	1	----	1	----	----	----
Mumps	186	13	----	2	1	18	68	13	26	23	22
Poliomyelitis	79	2	----	4	3	7	51	----	----	4	8
Scarlet fever	124	----	----	1	1	26	13	12	26	19	26
Tuberculosis (all forms)	188	28	----	1	7	38	23	22	6	19	44
Typhoid and paratyphoid fever	6	----	----	----	1	2	----	----	----	----	3
Venereal diseases.											
Gonorrhea	373	10	----	6	7	105	51	27	19	56	92
Syphilis	199	1	----	5	4	51	18	3	[1] 95	9	13
Primary	8	----	----	1	----	1	1	----	1	4	----
Secondary	8	----	----	----	1	2	4	----	1	----	----
Other	183	1	----	4	3	48	13	3	93	5	13
Other forms	1	----	----	----	----	----	----	----	----	----	1
Whooping cough	101	1	----	3	2	20	52	4	6	4	9

[1] Includes 92 cases of syphilis discovered as a result of a recent survey.

NORWAY

Reported Cases of Certain Diseases—May 1951

Disease	Cases	Disease	Cases
Diphtheria	4	Poliomyelitis	16
Dysentery, unspecified	34	Rheumatic fever	93
Encephalitis, infectious	2	Scabies	680
Erysipelas	313	Scarlet fever	108
Gastroenteritis	3,016	Tuberculosis (all forms)	317
Hepatitis, infectious	41	Venereal diseases:	
Impetigo contagiosa	1,455	Gonorrhea	158
Influenza	2,208	Syphilis	49
Measles	2,581	Other forms	4
Meningitis, meningococcal	9	Weil's disease	1
Mumps	143	Whooping cough	1,750
Pneumonia (all forms)	2,967		

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

The following tables are not complete or final for the list of countries included or for the figures given. Since many of the figures are from weekly reports, the accumulated totals are for approximate dates.

CHOLERA

(Cases)

Place	January–May 1951	June 1951	July 1951—week ended— 7	14	21	28
ASIA						
Burma	1,433	154	35	18	7	-
Akyab	7	-	-	-	-	-
Bassein	348	14	-	-	-	-
Kyaukpyu	-	-	-	1	-	-
Mergui	106	51	21	3	1	-
Moulmein	215	47	-	-	-	-
Rangoon	32	1	-	-	-	-
India	42,300	10,545	[1] 122	[1] 125	[1] 103	[1] 107
Allahabad	-	-	-	-	-	[2] 2
Bombay	3	-	-	-	-	-
Calcutta	3,245	1,037	112	103	95	101
Cawnpore	-	-	-	-	1	-
Cuddalore	7	-	-	-	-	-
Lucknow	3	12	-	11	2	4
Madras	206	100	10	11	5	-
Nagpur	68	10	-	-	-	-
Negapatam	87	-	-	-	-	-
Trichinopoly	105	5	-	-	-	-
Tuticorin	34	-	-	-	-	-
India (French)	179	72	-	[3] 48	[4] 83	-
Karikal	36	-	-	-	-	-
Pondicherry	143	-	5	9	-	-
Indochina:						
Cambodia	[5] 41	[6] 11	-	-	-	-
Viet Nam	23	4	-	-	-	-
Cantho	2	-	-	-	-	-
Haiphong	3	-	-	-	-	-
Soc Trang	2	1	-	-	-	-
Pakistan	11,882	606	[1] 13	-	[1] 20	[1 2] 14
Chittagong	42	6	3	-	-	[2] 14
Dacca	51	1	-	-	-	-
Thailand	1	-	-	-	-	-

[1] Preliminary. [2] Imported cases. [3] July 1–10, 1951. [4] July 11–20, 1951. [5] Includes suspected cases. [6] Includes imported cases.

PLAGUE

(Cases)

Place	January–May 1951	June 1951	July 1951—week ended— 7	14	21	28
AFRICA						
Belgian Congo	17	1	-	3	1	1
Stanleyville Province	17	1	-	3	1	1
British East Africa:						
Taganyika	[1] 42	-	-	-	-	-
Madagascar	131	1	-	[2] 1	[3] 2	-
Union of South Africa	13	-	-	2	-	-
Cape Province	-	-	-	2	-	-
Orange Free State	13	-	-	-	-	-
ASIA						
Burma	246	2	-	3	3	3
Rangoon	[4] 1	-	-	-	[4] 1	[4] 1
Tavoy	2	-	-	-	-	-
India	5,954	135	29	-	-	-
Allahabad	[4] 126	[4] 2	-	-	-	-
Bombay	[4] 1	-	-	-	-	-
Calcuta	20	-	-	-	-	-
Cawnpore	8	-	-	-	-	-
Lucknow	[5] 15	-	-	-	-	-
Nagpur	11	-	-	-	-	-
Indochina:						
Cambodia	26	12	-	-	-	-
Pnom Penh	7	8	-	-	-	-
Viet Nam	73	6	5	-	-	-
Baria	-	2	-	-	-	-
Cap St. Jaques	-	1	-	-	-	-
Phanthiet	42	8	-	-	-	-
Phu Kok Island	19	-	5	-	-	-

See footnotes at end of table.

PLAGUE—Continued

Place	January–May 1951	June 1951	July 1951—week ended— 7	14	21	28
ASIA—continued						
Indonesia:						
Java	5					
Bandoeng	1					
Djakarta	[4] 1					
Jogjakarta	2					
Semarang	[4] 1					
Madura	[1] 12					
Timbang	[1] 12					
Thailand	7					
SOUTH AMERICA						
Brazil	8	2				
Ceara State	6					
Pernambuco State	2	2				
Ecuador	16					
Chimborazo Province	10					
Loja Province	6					
Peru	3					
Chota Province	3					

[1] Includes suspected cases. [2] July 1–10, 1951. [3] July 11–20, 1951. [4] Imported. [5] Includes imported cases.

SMALLPOX

(Cases)

Place	January–May 1951	June 1951	July 1951—week ended— 7	14	21	28
AFRICA						
Algeria	46	39		[1] 1		
Angola	96					
Bechuanaland	146					
Belgian Congo	1,146	190	21	66		
British East Africa:						
Kenya	2		2			
Nyasaland	40	9	3	3		
Tanganyika	258	80				
Uganda	15	1				
Cameroon (British)	5					
Cameroon (French)	137	51		[1] 6		
Egypt	1					
Ethiopia	12	8				
French Equatorial Africa	104	24		[1] 7		
French West Africa	2,212	417		35	65	23
Dahomey	359	11		[1] 1	[2] 3	[3] 23
Guinea	9	1				
Ivory Coast	209	14		[1] 5	[2] 13	
Mauritania	13	3				
Niger Territory	774	101				
Senegal	3	1				
Sudan	627	255		[1] 28	[2] 45	
Upper Volta	218	31		[1] 1	[2] 4	
Gambia	1					
Gold Coast	337	26				
Morocco (French)	6					
Mozambique	97	8	14			
Nigeria	5,692	448			1	1
Rhodesia:						
Northern	1	1				
Southern	253	23				
Sierra Leone	23	1				
Sudan (Anglo-Egyptian)	18	14	5		5	8
Togo (French)	35			[1] 10	[2] 3	
Tunisia	7	1				
Union of South Africa	453	[4] 2				
ASIA						
Afghanistan	299	74				
Arabia	3					
Aden	[5] 2					
Oman	1					
Burma	582	28	2	[5] 1		
Ceylon	44	9	2			
China	5					
India	185,520	22,576	[4] 72	[4] 49	[4] 76	[4] 33
India (French)	2,284	155		[1] 9	[2] 51	
India (Portuguese)	158	1	8			

See footnotes at end of table.

SMALLPOX—Continued

Place	January–May 1951	June 1951	July 1951—week ended—			
			7	14	21	28
ASIA—continued						
Indochina:						
Cambodia	78	23			2	
Viet Nam	962	347	66	47	27	20
Indonesia:						
Borneo	1,130	65		3		
Java	148	24	5	5	5	
Iran	239	25	7			
Iraq	134	26				2
Japan	52					
Korea	474					
Pakistan	32,835	2,717	[4] 42	[4] 31	[4] 34	[4] 43
Straits Settlements	1					
Syria		1				
Thailand	33		[1] 1			
Turkey	120					
EUROPE						
Great Britain:						
England: **Brighton**	15					
Portugal	19					
Netherlands	52	2				
NORTH AMERICA						
Guatemala	2					
SOUTH AMERICA						
Brazil	3	6	1			
British Guiana	11					
Colombia	25	3				
Ecuador	103	4				
Paraguay	20					
Venezuela	41					

[1] July 1-10, 1951. [2] July 11–20, 1951. [3] July 21-31, 1951. [4] Preliminary figure. [5] Imported.

TYPHUS FEVER*

(Cases)

Place	January–May 1951	June 1951	7	14	21	28
AFRICA						
Algeria	50	9		[1] 1		
Belgian Congo	1	7				
British East Africa:						
Kenya	15	2				
Somaliland	1					
Uganda	4					
Zanzibar	1					
Egypt	6	2	1			1
Eritrea	13		2			1
Ethiopia	404	180				
Gold Coast	3					
Libya:						
Cyrenaica	3	2				
Tripolitania	13					
Morocco (French)	2	6				
Morocco (Spanish)	15					
Nigeria	1					
Tunisia	15	5				
Union of South Africa	42					
ASIA						
Afghanistan	368	110				
Ceylon	3					
India	61	19		[2] 4	[2] 3	[2] 1
India (Portuguese)	33					
Indochina: Viet Nam	31					
Iran	215	28	5	3	1	1
Iraq	36	9	5	2	1	5
Israel	2					
Japan	10					
Korea	126					
Pakistan	13					
Syria	1					
Transjordan	43	2				
Turkey	93	20	7	1	3	1

See footnotes at end of table.

TYPHUS FEVER—Continued

Place	January-May 1951	June 1951	July 1951—week ended— 7	14	21	28
EUROPE						
Germany (French Zone)		1				
Germany (United States Zone)		1				
Great Britain.						
Island of Malta	1					
Ireland						[illegible]
Italy	10	1				
Sicily	10					
Portugal	32					
Spain	1	14				
Yugoslavia	284	20				
NORTH AMERICA						
Costa Rica	[3] 7					
Guatemala	13					
El Salvador	[3] 4					
Jamaica	[3] 8			[3] 4		
Mexico	[4] 40	16	1			
Puerto Rico	1			1		
SOUTH AMERICA						
Chile	77	13	6	5	3	4
Colombia	32					
Ecuador	[4] 374	[4] 65				
Paraguay	11					
Venezuela	[3] 10	1	[3] 1			

*Reports from some areas are probably murine type, while others include both murine and louse-borne types.
[1] July 1-10, 1951. [2] Preliminary. [3] Murine. [4] Includes murine type.

YELLOW FEVER

(C—cases; D—deaths)

Place		January-May 1951	June 1951	July 7	14	21	28
AFRICA							
Gold Coast	C	[1] 21	2	[2] 2	[2] 3	[2] 3	[2] 1
Accra	C	[1] 5					
Adeiso	C	[1] 6					
Sierra Leone	C	[2] 2					
Koinadugu District	C	[2] 2					
Freetown	C	[2] 2					
NORTH AMERICA							
Costa Rica	C		1				2
Limon Province	C		1				2
Panama	C	1	1				
Bocas Del Torro Province	C	1	1				
SOUTH AMERICA							
Brazil	D	[3] 400					
Goiaz State	D	[3] 400					
Anapoli	D	[4] 1					
Goiania	D	[4] 2					
Goiaz	D	[4] 5					
Inhumas	D	[4] 1					
Jaraqua	D	[4] 6					
Mineiros	D	[4] 2					
Niquelandia	D	[4] 3					
Pirenopolis	D	[4] 1					
Porangatu	D	[4] 1					
Rio Verde	D	[4] 2					
Uruacu	D	[4] 2					
Matto Grosso State	D	3					

See footnotes at end of table.

YELLOW FEVER—Continued

Place		January–May 1951	June 1951	July 1951—week ended—			
				7	14	21	28
SOUTH AMERICA—continued							
Colombia	D	13					
Boyaca Department	D	1					
Otanche	D	1					
Caqueta Commissary	D	2					
Montanita	D	1					
Meta Territory	D	1					
North Santander Department	D	3					
La Vega	D	3					
Santander Department	D	7					
Campohermoso	D	1					
Guamales	D	1					
Maradales	D	1					
San Vicente de Chucuri	D	1					
Tambo Redondo	D	1					
Venegas	D	1					
Ecuador	C	61					
Esmeraldas Province	D	1					
Atacames	D	1					
Quininde	D	1					
Santo Domingo de Los Colorados	C	58					
San Meguel	D	1					
Peru	D	4					
Huanuco Department	D	1					
Junin Department	D	1					
Loreto Department	D	1					
San Martin Department	D	1					

[1] Includes suspected cases. [2] Suspected. [3] The number of deaths, Dec. 1–Feb. 20, 1951, was estimated to be 400 and the number of cases was estimated to be 2,000. [4] Confirmed deaths.

U. S. Marine Hospitals Renamed

The 21 hospitals operated by the Public Health Service under the name "United States Marine Hospitals" have been redesignated as "United States Public Health Service Hospitals," thus providing a uniform designation for the 23 hospitals operated by the Service.

Affected by the change in name are 18 general hospitals located in ports along the Atlantic, Pacific, and Gulf Coasts, the Great Lakes, and the Mississippi River; two tuberculosis hospitals at Fort Stanton, N. Mex., and Manhattan Beach, N. Y.; and the leprosarium at Carville, La.

A neuropsychiatric hospital at Fort Worth, Tex., and another at Lexington, Ky., opened in the 1930's primarily for treatment of people addicted to narcotic drugs, have been known as United States Public Health Service Hospitals.

Since 1798, when President John Adams approved legislation creating a medical care program for merchant seamen, Congress has increased the number of groups entitled to treatment at the hospitals, and the old designation no longer described the functions performed. Besides American seamen, the hospitals treat officers and enlisted men of the Coast Guard and Coast and Geodetic Survey, Federal employees injured at work, and other groups designated by Congress as Federal beneficiaries. Activities of the Hospital Service also include research and preventive medicine.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price $4.75 a year. $6.25 foreign

Public Health Reports

VOLUME 66 **SEPTEMBER 7, 1951** NUMBER 36

TUBERCULOSIS CONTROL ISSUE NO. 67

IN THIS ISSUE

Medical Social Service in a Tuberculosis Sanatorium

BCG Vaccination on a World-Wide Scale

U.S. PUBLIC HEALTH SERVICE 1798

FEDERAL SECURITY AGENCY

PUBLIC HEALTH SERVICE

FEDERAL SECURITY AGENCY
Oscar R. Ewing, Administrator

PUBLIC HEALTH SERVICE
Leonard A. Scheele, Surgeon General

Division of Public Health Methods
G. St. J. Perrott, Chief of Division

CONTENTS

This is the sixty-seventh of a series of special issues of PUBLIC HEALTH REPORTS devoted exclusively to tuberculosis control. The special issues began March 1, 1946, and appear the first week of each month. The articles are reprinted as extracts. Effective with the July 5, 1946, issue, these extracts may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents a single copy. Subscriptions are obtainable at $1.00 per year, $1.25 foreign.

Public Health Reports

Vol. 66 • SEPTEMBER 7, 1951 • *No. 36*

Medical Social Service in a Tuberculosis Sanatorium

By Pauline Miller, A. M.*

Editor's Note: This concludes the article which began in the preceding Tuberculosis Control Issue, No. 66, August 3, 1951. A single reprint containing both parts of the article will be available in the near future.

Economic Aspects

"If my wife breaks down under the strain of working and looking after the children and running out here to see me," said a patient with suitcase in hand as he was leaving the sanatorium one morning, against medical advice, "there won't be too much point in my getting well. I'm going out to see for myself whether there isn't some way of looking after a family caught in this kind of trouble."

The long continued period of medical care almost invariably involved in tuberculosis tends to drain accumulated savings from most patients and families; only a very few can stand the full cost of all the ramifications of tuberculosis from their savings or the earnings of the rest of the family. In any case, even without financial problems, families carry a heavy burden in terms of their psychological need for the person who is ill and away from home. But in most families there is also the burden of financial readjustment, lowered standards of living, assumption of the wage earner's role by somebody else, interrupted schooling and uprooting of children.

A family with substantial strength in the individual members and in the family relationship sometimes realizes latent potentialities and emerges from the illness with new cohesion as the experience of illness and separation brings to light hidden capacities and new facets of personality, and newly discovered qualities in their relationships. The patient himself, however, often suffers from a constant undertow of anxiety, guilt, and insecurity because of the financial straits in which he has left his family. Having given up his job and having relinquished his proper share of family responsibility perhaps with much reluctance,

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he continues to feel inadequate as each financial crisis in the family comes to his attention, and he often remains in constant conflict and indecision as to whether to stay in the sanatorium at all.

At least two other aspects of financial need affect the process of treatment in a sanatorium and are at times overlooked in the light of the more accentuated needs of families without breadwinners. One is the problem of the patient with savings who enters the public sanatorium because he cannot afford private sanatorium care, and who exhausts his savings in the period of treatment because he is required to pay for his hospital care. Even institutional living requires some money and creates still another aspect of need in the sanatorium for the patient without resources and without a family that can supply him with money to meet the simple everyday needs that are not met by the sanatorium. We shall discuss these aspects of the financial question in more detail later.

Maintenance for Families

For most families there are not many ways to secure alternative income for maintenance. The wife may take on work outside the home, or roomers in the home; children may be taken out of school and sent to work, or working children asked to take on added financial responsibility; savings or insurance or property may be converted to cash for immediate use; or the family may turn to public assistance. In comparatively few instances can families depend completely on aid from relatives although such assistance is often significant in supplementation of other sources of income.

Whichever of these alternatives or combinations of them the particular patient has agreed upon with his family, he is likely to have qualms and questions because, at best, they are only substitutes for his place in the family as breadwinner. The amount of guilt and anxiety he experiences in this circumstance varies considerably for each person—with the stage of his illness, the role he has played in the family, the maturity and resilience of the wife and mother, and the patient's own capacity to accept realistically changes in his circumstance. Families may develop well-thought-out plans for meeting the crisis of illness and still have to face new planning at intervals because during the long hospitalization and convalescence for tuberculosis many changes in the family situation necessarily occur.

Doubtless, many women who have had to assume responsibility for the family's support because of their husbands' illness achieve a fuller stature by reason of that fact. But when the mother, as the only parent at home, must devote her major energy to supporting the family and helping sustain the morale of a sick husband, she has little left for the children and their concerns. And everyone stands to lose—the child, the family, and the community—when children

must leave school before they have a definite vocation to carry them through life.

Public assistance provides eligible families of patients with some financial help during a parent's illness. Although many families do not receive such assistance, it is invaluable in individual cases. In large sections of the country the money provided is inadequate, so inadequate in fact, that, for example, it represents little real opportunity for a woman to choose between going to work to support the family and staying at home to devote herself to her children(4).

Financial Planning Prior to Hospitalization

In the circumstance of both the chief wage earner and the mother who become ill, time is lost and harm is done when patients are hurried into a sanatorium before they have decided upon a solution to the family situation which they feel will work. Sometimes, of course, danger of infecting an infant or the patient's medical condition dictates immediate hospitalization, and a few weeks or even a few days are important. But in most instances and in the long run when a patient comes into the sanatorium before he is satisfied that he has made the best possible plan for his family, the cost in sleeplessness, hours of conflict and guilt, or actual walkout often wipes out the hoped-for immediate gain.

A family story of financial breakdown recurred with some frequency among patients who came to the sanatorium. In each case the patient and his family had had similar experiences. First, there was a period of treatment in a private sanatorium because they believed that the cost of private care during a few months of illness could surely be met. Then when this period was extended beyond their expectation, the gradual loss of savings and of property investments in business and home resulted in an effort on the part of the patient to salvage the situation by coming out of the sanatorium too early. Eventually a second or third breakdown involved the necessity for readmission to a sanatorium, this time under public auspices. The family situation had grown worse and was in turn reflected in the patient's anxiety and frustration. In each such instance, one could not but ask whether this family could have been helped, at the time of the diagnosis or sometime earlier, so that they might have planned more realistically and in more far-sighted ways and thereby possibly have avoided such complete loss of resources and status in their own eyes.

Doubtless euphemisms like "a few months and you'll be well again" are directed with all sincerity toward easing the reality of tuberculosis. But patients must deal with the reality, and the danger of the too casual early optimism is that it leads patients into unsound personal planning for themselves and their families. Even with help and an

entirely direct approach, patients have difficulty in understanding fully the potential ramifications in their lives of the disaster of tuberculosis. The social worker who is available to help people face and deal with problems in terms of their real situations can bring to them her knowledge of community resources as well as of the experience of numerous other families. She should be at hand in tuberculosis clinics to work with patients and families starting to face tuberculosis.

It might also be noted that inadequate statements about probable length of cure are remembered with bitterness and resentment which tends to be projected upon the medical and nursing staff in the sanatorium, making their task more difficult. The distrust engendered by an initial "reassuring" statement, made at the time the patient learned of his diagnosis, continues to rankle in the patient because he comes to realize that the reassurance was clearly unrealistic or definitely untrue.

The problems encountered by two families who found quite different ways to solve their financial problems are presented because they are fairly characteristic of the type of solution to which patients turn when the head of the family becomes ill with tuberculosis. They may also serve to throw into relief not only the heavy financial burden tuberculosis places on a family, but also some of the psychological concomitants of family strain under such circumstances and the pull toward leaving the sanatorium that patients must cope with constantly. In the first case, the family drew on their own resources—the wife and children worked, they used their savings, and relatives helped. The second patient turned to public assistance.

A Family's Effort to Absorb the Burden

The first of these cases is of considerable interest because it indicates what families do in their determination not to call upon public aid. At tremendous cost, the immediate family and relatives bring their resources to the sick member during crises in his situation, only to find that they cannot maintain this all-out effort once the crisis is over and the patient is on his way to recovery.

The patient, Mr. Williams, was a man of quiet dignity, thoughtful and sensitive in manner and appearance. Admitted to the sanatorium with far advanced bilateral pulmonary tuberculosis, he was so weak and ill for many months that he was primarily engrossed with the question of whether he would survive at all. His survival and his eventual discharge from the sanatorium at the end of 2½ years, following a carefully planned medical program which included extensive surgery, was at once a tribute to the medical service of the sanatorium and to the devotion of this patient's relatives. The patient's brother, for example, had mortgaged his home in order to buy streptomycin when it was first on the market and funds for its purchase had not yet been allocated to the sanatorium. For the first year and a half of the patient's illness, his brothers and sisters continued to find ways of meeting special financial needs of the family as they arose.

At that point, crises developed in their own families which required all their resources. Mr. Williams was well on the way to recovery, and he and his wife, concerned over the amount of financial support they had already accepted, felt they could neither ask nor accept more from his brothers and sisters.

Mrs. Williams had more than carried her share of financial responsibility during the patient's illness, having established herself as a saleswoman in an exclusive dress shop. The three attractive adolescent children worked at after-school jobs, and Mrs. Williams had supplemented her earnings by taking in roomers until her own ill health led her to give up their fairly large rented house and move into an inexpensive apartment. With considerable reluctance, the family had to agree at that point that the oldest son who was now 18 should give up his schooling in order to help. This was particularly difficult because the boy had had an excellent school record and he and the family had long planned on an engineering career for him.

About a year and a half after Mr. Williams entered the sanatorium, Mrs. Williams had to undergo a breast amputation, and both she and her husband were fearful of a possible malignant cancerous condition, their fears not entirely allayed by reassuring but necessarily cautious statements of her doctor. The long period of strain took its toll psychologically, and she was increasingly turning to her husband to help her in her fears about herself and in the growing tension between her and their adolescent children.

The family had put all their strength into weathering the first period of illness, extending over nearly 2 years. They found themselves depleted, straining under differences that were perhaps to be expected with three adolescents in the home, but which, by reason of the father's absence, became accentuated to the point of open friction and prolonged strife. A financial crisis developed when Mrs. Williams found herself facing a 3-weeks' convalescence at home after a second operation. She had exhausted her money through two periods of hospitalization, and the family was having a very hard time, but they could not bring themselves to turn to the relatives who had already carried so much of the financial burden. Obviously, this family needed help well before this time. It may therefore be appropriate to recall to the reader that in our sanatorium one social worker was available for some 600 patients, so that her services were called upon in selected cases only, as the need for services became relatively urgent.

After Mr. Williams had reached a point of enough physical improvement so that he could believe that he would eventually return to his family, he began to review their financial and social situation with growing anxiety and increasing need to assume his old role as responsible head of the family. He began to speak at length of his life.

Coming to know the patient and his feeling about himself and his family, the social worker learned that he had been largely self-supporting since early childhood. With the early death of his father, he had gradually taken over much of the financial responsibility for rearing younger sisters and brothers, and in his own home, as in his mother's home, he had been the one to whom the family looked for all important decisions. His illness had followed a period of financial reversals and the loss of a business establishment of his own.

When the medical social worker was drawn into the case, she found that there were days in which the family literally had no food in the house, and she was able to arrange for temporary financial assistance through an anonymous contribution from a church group. This was an uncertain source of aid, it is true, but one that was immediately accessible and which the family could bring themselves to accept more quickly than they could the thought of formal application to a public agency. The children needed immediate medical and dental service which was provided by arranging for the use of appropriate resources in the community.

This patient's need, in the light of his personality and the family situation, to take on increasing responsibility was discussed with the doctors. They decided to allow Mr. Williams more than the usual leeway in terms of days out with his family. They requested, however, that provision be made for automobile transportation which would relieve the physical strain of going to and from the city.

To relieve some of the psychological burden which was devolving on this man before he was considered medically ready to assume full responsibility, he was given opportunity to discuss the difficulties in the family situation and to clarify his own approach to the problems of the home. He said that in talking with the medical social worker he often arrived at a clearer understanding of his situation at home. He could work out ways to handle such problems as his wife's crying spells and fearfulness about herself, and the growing separation of the children from the parents.

More than once the patient came back to a subject that obviously preoccupied him, namely, how he could take his place in the family without the frequent expressions of affection and demonstrativeness which had formerly been the family pattern. He could not believe that he was entirely without danger to his family as a possible source of infection, and yet he felt that his constant awareness of that fact would set up a barrier between himself and his children. It did not help that he knew intellectually that he was no longer infectious. He was struggling rather with his feelings: a sense of being apart from others, as well as guilt for having in the past exposed his own children to his infection. The social worker respected his feelings and attempted to provide him with an atmosphere in which he could articulate his anxieties and questions, evaluate them himself, and sift out what was valid and important. During this psychological movement toward resumption of full responsibility, he knew that someone understood how uncertain he felt about himself, accepted his uncertainty, and yet believed that he could take the necessary steps toward independence and responsibility. His medical and social progress were carefully followed by the doctor and the social worker, and the decision as to the appropriate time to discharge him to the convalescent home was reached in terms of his physical condition and his need to be nearer his family. Subsequent information indicated a fine adjustment on the part of the patient and the family in working out their problems.

The family as a whole came near to a breaking point during Mr. Williams' illness; Mrs. Williams was both physically and emotionally drained under the weight of the burdens she had carried for some time; their son, a most promising young man, interrupted his schooling and the patient in the sanatorium was placed under heavy emotional stress. Mrs. Williams certainly waited too long before she accepted medical care for herself, knowing as she did that once her income was interrupted she might expose her children to need. And as it happened her lack of income for a time did expose them to occasional days of actual hunger, with resultant tension, bitterness, and family disorganization. It is true that she might have applied for help from Aid to Dependent Children or General Assistance, but she knew that the process of application and receipt of aid was long-drawn-out in her community, so drawn-out that she might well be back at work before she received assistance. She also knew that the assistance she might get would be most meager in relation to the needs of her

family. And most of all, she felt that her relatives, friends, church associates and, in fact, she herself tended to look down upon anyone who accepted assistance from public funds.

In this case a church group eased the financial strain. In many other situations, where need was fully as great, there was no group or agency to meet the situation. A whole set of facts in our present approach to illness and to assistance are called into question by this case: problems of coverage of assistance programs, amount of grants, length of time it takes to make application and receive assistance, community and personal attitudes towards public assistance as a proper solution to economic need in some circumstances.

When patients or families are advised to solve their problems by applying for public assistance, recognition is not always given to the fact that the process of bringing oneself to apply for assistance is complex. Adults expect to be self-supporting; their personal goals and their sense of adequacy are involved in giving up self-support and turning to others for maintenance. Public opinion supports them in their attitude that assistance must indeed be a last resort, not to be drawn upon until savings, aid from relatives, and every possibility of employment by other members of the family have been exhausted.

The effects of waiting too long—until the wife is exhausted and ill, for example—and of getting too little, once assistance is received, can be observed daily. We see tension resulting from anxiety about money, restlessness and even walk-outs of patients provoked by concern over the family's needs. How closely related such anxiety is to the family situation was evidenced by the fact that, whenever a cut in public assistance grants occurred in the city, requests for appointments with the medical social worker piled up as patients urged that some special attention be directed to the needs of their individual families. When people's needs are not met, the health official responsible for the control program finds some of his efforts weakened.

A Public Assistance Application

Mr. Johnson, the second patient, turned to public assistance shortly after the discovery of his tuberculosis. He was vividly described by the case-worker from the Public Assistance Division, who said that he had come "storming" into their office, "half crazy with grief and anger," seeking assurance that, if he should go into the sanatorium, his seven children and his invalid wife would be cared for adequately. Mrs. Johnson had just been released on probation from a mental hospital, and her mother had agreed to come into the home to look after the family for the present.

Mr. Johnson, a pipefitter by trade, had suffered a sudden onset of his disease, hemorrhaging in the streetcar on his way home from work. At the time he was admitted to the sanatorium, the diagnosis was "pulmonary tuberculosis, far advanced, bilateral."

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This patient was particularly irritated by the watchwords that he heard often during his first week at the sanatorium. "Try not to worry, rest and relax, relax and rest," sounded meaningless to him in the first sleepless nights. He described his problem in taking bedrest, "All night long I find myself figuring how in the world my mother-in-law is going to feed nine people and buy shoes and pay the rent on the public assistance allowance of $138 a month when I couldn't manage on my wages of $80 or $90 a week."

It was not too long after his admission to the sanatorium before his wife had to be readmitted to the mental hospital and related social problems developed. Two children were reported truant from school, one was in need of medical care; their house was unfit and no other housing was available immediately.

The medical social worker to whom Mr. Johnson turned in his dismay at the mounting accumulation of problems had opportunity to see the wretched home conditions of the family in the course of a home visit made at the patient's request, and to know for herself that the family needs were by no means exaggerated in the patient's mind. Appropriate authorities condemned the house and assigned the family priority in a housing unit. Eventually they were able to move into a public housing project. Mr. Johnson's stay in the sanatorium was made a bit easier through a small monthly allowance provided from the welfare fund of the sanatorium, so that he could meet his own needs without undue embarrassment. He was most grateful for reports which the social worker could get for him about the children and about his wife in the mental hospital.

This patient's family undeniably had difficulties. The concrete services that were given were limited by reason of inadequate community resources—inadequacy of public assistance funds, cumbersome and relatively limited provisions for housing for low income families, insufficient funds available for meeting financial need within the sanatorium itself and paucity of child guidance and recreation facilities for the children of the family. The practical help provided to the patient was therefore certainly not great although here and there it eased the pressures a bit, both on him and on the hard-pressed mother-in-law who had undertaken to hold things together in the family while both parents were ill.

Despite limitations of community resources, the patient was able to draw upon the social worker's knowledge of these resources and her ability to deal with community agencies on his behalf. He drew also upon the social worker's capacity to understand how hard it was for him, in the light of the family circumstance, to bring himself into the sanatorium and to remain there until medically discharged. The patient could tell the social worker, at length, of his deprived childhood and interrupted education, and find a sympathetic response; he could reiterate his determination and dream that his boys would have a better chance in life—that is, if he lived to give it to them. He wanted reassurance frequently on the question of whether he was deserting his family by placing himself under medical treatment. Wasn't it better, he asked her, and obviously had been asking himself, to come in now and go out well, so that he could really take care of the children properly, than to stay on the outside and work until he dropped on the streets? When, as often occurred, he reported his anxiety about finances and his concern as to the details of managing on the assistance allowance, the social worker was able to bring him back to the fact that his mother-in-law had willingly assumed responsibility for the household, that management of the family allowance was her job for the present, not his, and that he had no reason to doubt her strength to carry her responsibility. He agreed that his illness and his stay in the sanatorium demanded that he relinquish these responsibilities to her. The social worker helped by letting him unburden his sense of guilt and by supporting his determination to regain his health both for himself and on behalf of the children.

The patient did remain on bed rest in his 17-month stay at the sanatorium, and there was reason to believe that the services provided, both practical and psychological in nature, were reflected in fewer sleepless nights, in the patient's continued determination to work at getting well, and in an accelerated movement out of the sanatorium.

The policies of the department of public welfare and the responsiveness of the case worker there resulted in prompt action in providing for this family, on a minimum subsistence basis at least. Technicalities of law and limited finances in many communities often prevent the public assistance agency from giving assistance in situations that are equally pressing.

Neither of the two situations that have been presented in some detail was limited to financial problems alone. The fact is that few, if any, family situations involving tuberculosis are uncomplicated by social factors or psychological attitudes peculiar to the family under consideration. Nor is the part played by the social service department usually restricted to concrete services of a practical nature, important as these are. Social and emotional problems presented by patients require a response in human terms—in terms of understanding and psychological support for what has to be lived through.

Desirability of Sanatorium Care at no Cost to the Patient

Any adequate consideration of the so-called "means" test is obviously outside the scope of this paper. Out of the experience that is under review, the writer can testify, however, that the requirement for payment in the public sanatorium does impose considerable hardship on individuals and their families and is a source of continuing anxiety. The more farsighted and resourceful the individual, the more likely he is to have savings which can be drawn upon for his care and therefore the more likely it is that he will be required to pay for sanatorium care. But his habit of planning and frugality may mean he is the more in need of financial security and the more disturbed as he sees his savings dwindle and anticipates being left without resources on discharge. Once his resources are depleted he may attempt to get well away from the sanatorium even though the sanatorium offers him his best chance at recovery; or, he may stay in the sanatorium, often suffering from a sense of having no anchorage to which to hold when he is discharged.

For most people of medium income, the accumulation of savings of \$2,000–\$3,000, for example, represents sacrifice of comforts and luxuries over many years, and in fact may have contributed to the breakdown if achieved through self-denials in nutrition, overwork, and concern about savings. Such a sum is exhausted in 1 or 2 years, even though the amount requested for hospital payment may be quite small—as little as \$2 or \$3 a day. Repeatedly, patients readily agree to

the amount requested for sanatorium care, for it is indeed more than reasonable as compared to the benefits to be derived. Once in the sanatorium, however, the patient encounters a number of unanticipated demands on his financial reserve. Most characteristically, he finds himself hospitalized for many months and even years, instead of the limited number of months which in his own thinking he had "allowed" himself. With a date for resumption of earning capacity still far off, he sees his hospital payments eat into his savings steadily and knows that he may be penniless when he leaves, and still be unable to work.

In those States in which the practical significance of free sanatorium and medical care as a policy has been recognized on a State-wide basis, the individual is free from the anxiety entailed in the effort to meet the continuing cost of hospitalization and the concern and guilt involved in knowing that his family is carrying this burden for him. Too many patients face the move out of the sanatorium with an uneasy uncertainty about the future. If they have had the foresight or the good fortune to accumulate some financial resources which may make it possible to leave the sanatorium and undergo convalescence without immediate financial worries, is it not important to enable them to do so?

Patients' Need for a Source of Income in the Sanatorium

Although the sanatorium provides maintenance to patients, those who have neither personal resources nor relatives and friends who can supply them with the necessities they require are in need of a small allowance. The patient needs money for pajamas, bedroom slippers, bathrobe, shaving materials, or an occasional "day out" in the city. Few public sanatoriums have adequate provisions to meet this need, although in actual practice various makeshift devices are used for the purpose. The having and handling of money with which to meet one's own needs is often more important in our social economy than the specified items involved. It is symbolic of adulthood and adequacy (*5*). Tuberculosis forces dependence in any case, and the adult who has no money in hand and no immediate prospect of earning any feels himself more helpless, less vitally a part of the world he lives in, more shut off from normal channels of everyday living. This is true even though the only channels open to the patient in the expenditure of his funds may be mail orders and the sanatorium commissary. "Folks figure you're dead as soon as you come out here," said one man left stranded by relatives and friends. His small monthly allowance from the social service department made him feel related again in small part at least to the outside world and to normal living.

Without financial support, the stresses of the outside situation and

the insecurity and sense of helplessness within the sanatorium rob the patient of needed rest. His energies are dissipated in efforts to overcome conditions that he cannot in any case bring under control as long as he is ill. To have the means to meet his illness with dignity and to maintain his status as a member of a family and community may in the individual case prove as important in the management of a man's disease as the exquisite precision of the surgeon working directly on his lung tissue.

Nonresidence

There is one more group of patients who merit attention, the nonresidents, those who are not entitled to hospitalization because they do not have local legal settlement or residence. Such persons sometimes are hospitalized on an emergency basis while efforts are made to return them to their legal place of residence, if any. Often, sick people who require hospital care simply do not receive it because they cannot be admitted to local hospitals, or they have no legal place of residence anywhere, or because having become established in their present homes they cannot uproot themselves and their families and go back to a place which is no longer home or where they have no ties. And so, in addition to all the emotional and social problems related to the illness itself, this particular group suffers from lack of adequate medical care and often from lack of social assistance. This is true when all or most of the services of the community are closed to them because they technically are considered nonresident. Their problems are not discussed in detail in this paper because nonresidents are not admitted to this sanatorium. Patients in need of emergency care are hospitalized elsewhere. But many of this group, in this city as in many parts of the Nation, do not receive hospital care and are often uncared for socially as well.

Parents as Patients

It is obvious that there is no entirely good solution to a problem of such personal intensity as separation of a parent from his children, especially when the children still need him very much, and the parent leaves the home not knowing whether the separation will prove to be temporary or final. When the mother or father goes away to a distant place known as a sanatorium; when children are uprooted from their homes or cared for by relatives or in foster homes; when they can see their mother or father only through a screened porch window of a large, unfamiliar, and possibly formidable building; and especially when adults speak with mournful tone and enigmatic phrase of the sick parent, tuberculosis exacts a costly toll from children.

Because the parent becomes a potential source of infection to his child, indeed an actual danger to him, his behavior with the child is altered and seems to the child unnatural. An obstacle is inevitably set up in their relationship. The writer sensed at times an acute dismay in a patient struggling with the realization that he himself might be his child's greatest source of danger. A feeling of personal guilt is a common reaction.

A full substitute for parental care is rarely available, and even if it exists it is likely to cause jealousy and uncertainty in feeling on the part of the parent who fears he is displaced, perhaps permanently, in the life of the child. To work out appropriate plans for his children is only the first task of the parent; he must still cope with his feelings about separation from his children and their growing attachment to a different parent-person. He may also have to face reconsideration of his plans, no matter how carefully they have been made. Changes in the lives of the substitute parents or in the needs of the children necessitate new provisions for children, each shift in plans representing a crisis and often raising the issue with the parent as to whether he should remain in the sanatorium or go out to take over the adequate care of the children.

Patients are encouraged to come into the sanatorium quickly, once the diagnosis has been made and a bed is available. Sometimes a bed is ready, however, before adequate arrangements for the care of children are worked out, and patients come into the sanatorium without feeling satisfied that their children will receive consistent care on some dependable basis. Anxious and in continued conflict as to their proper course of action they do not achieve the relaxation nor yield to the routine prescribed by medical recommendations, and sometimes they finally leave against medical advice. Given a few more days or even a few weeks and the development of a dependable plan for their children, these same patients coming into the sanatorium would be psychologically prepared to put their energies into their treatment, and an actual saving in time would, in most instances, have been effected in the total period away from the children. And the children would have been spared some shifts and moves and insecurity.

A child has his own ways of punishing a parent who, to his mind, has deserted him. Patients report uncomprehendingly the statements of their young children that they like grandma's home better or that they have more fun or toys or freedom at the foster home than in their own homes.

In fragmentary statements, in a momentary frown of pain, in defensive anger or bitterness, as well as in frank yielding to tears, patients give glimpses of the depth of their feeling about isolation from their children. In one patient's discussion a passing comment,

"lying awake all night figuring out what I was going to say to the kids and especially how I was going to explain my mask and wheel chair," revealed at once the longing and the uncertainty of response which this woman felt so keenly that she was kept awake wording statements to her own children, unable to trust the normal spontaneous give-and-take of mother and child. The writer recalls also a patient's report of a telephone conversation with her 4-year-old child, in a foster home. The child, after listening to her voice for a time, told her that *he hoped it was her voice, but he didn't believe it, really, since she must be dead—he felt sure she would have come to see him if she were alive.* "And you know, don't you," she asked, giving up an effort to control her tears, "how hard it was not to call him all this time when I was trying to let him get used to the foster home?"

This then is the emotional problem: For the child, there is bewilderment, as well as a sense of rejection at times, and the need for adapting to parent-substitutes and often to new home settings as well. For the parent, loss and hurt result from his inability to maintain his rightful place of responsibility in the care and development of his child and possibly in his child's affections; he experiences anxiety and guilt because his infectiousness may be, or may have already been, a threat to his child's health and life; and he is concerned with the problem of working out a sound method of caring for his child.

Yet parents with tuberculosis must receive treatment and care, and a home in which their children place constant demands upon them does not usually assure the complete rest they need even when they can obtain adequate medical care. At the same time the children need physical care, training and supervision, and affection; in addition, they must be protected from the parent's infection. What resources in our communities, whether medical or social, will serve most adequately the needs both of sick parents and of their children? Have we put our most thoughtful efforts into providing social resources in order to minimize the effect of the misfortune of tuberculosis on parents and on children?

Substitutes for Parental Care

The usual solutions to which patients resort for the care of children, especially when it is the mother who is to be admitted to a sanatorium, include: (1) arrangements by which the children, and sometimes the husband, move in with relatives; (2) housekeeping service in the home, with the husband and children remaining together; (3) the help of a relative who can come into the home to live there and supervise the children and household; (4) placement of the children in foster homes, located and financed with or without the help of a child welfare agency.

While no solution may be really good, some solutions are better

than others, and it is a matter of constant frustration to patients, and incidentally to social workers trying to help them, that the community is seldom completely organized to provide the resources most acceptable to parents. Other things being equal, it is more desirable to keep children in the home in which they are living when the mother becomes ill and has to enter a sanatorium. The parent's illness becomes more drastic than need be in its effects on the children when they are deprived not only of the sick parent, but simultaneously of both parents and are, in addition, required to make an adjustment to parent substitutes within an unfamiliar setting.

Even in their own homes, the children have to adjust to accepting care at the hands of a relative or housekeeper in place of the mother, but they are at least in a setting that is familiar, in which the mother's influence persists in every detail of the household, and most important of all, in which they have the benefit of continued closeness with the father. With his home held together, it may be assumed that the father's ability to maintain his family intact through the long period of illness is further strengthened. Permanent family breakdown in some cases of tuberculosis can be traced to the initial physical disruption of the household, with the children placed away from home, one parent in the sanatorium, and the other left adrift to find his sense of home and personal satisfactions as best he can.

Some families have relatives ready and willing to take the responsibility of managing a household and caring for children in the mother's absence. In families less fortunate, housekeeping service provided by a qualified and competent person on a paid basis is needed to make it possible to maintain children in their own homes during the parent's illness and absence. Housekeeping services are necessarily costly, however, and even when housekeepers of appropriate qualifications can be found, families of average income cannot afford to employ them.

Child welfare agencies, public and private, can play a most strategic role in the lives of tuberculosis patients who have children. In the community under discussion, they stood ready to offer services not only in locating reliable foster homes and placing and supervising children in them, but also in exploring the possible use of relatives' homes in other communities through inter-agency correspondence.

It may be of interest to look at two case situations: in one, the family turned to relatives as the solution to their problem; in the other, to the public child welfare agency for foster home placement and supervision.

Use of Relatives

The example of a patient who placed her children with her mother is of interest in showing some problems that arise in such an arrange-

ment. Housekeeping aid services in this case were provided on an emergency basis. The patient faced constant pressure to leave the sanatorium as the needs of her children were urgent and immediate, and these needs obscured at times her own less immediate, less tangible goal of regaining her health in the sanatorium.

A 22 year-old woman was referred to the social service department by the doctor on the ward, because of a crisis involving her children. The patient, Mrs. Orchard, had been admitted with minimal pulmonary tuberculosis. It is important to know that her maternal aunt had left the sanatorium twice against medical advice and had died in this sanatorium a year earlier, a fact which the patient and family kept constantly in mind.

The patient's stated problem centered around adequate plans for her three children, all under 5 years of age, who, together with her husband, had moved into the home of the patient's mother. Her mother was employed as a waitress from 3 to 11 p. m., and her father and sisters refused to have any part in the care of the three small children.

The initial help given to this patient by the social service department was in arranging for housekeeping aid service, for 2 weeks at a time, to enable her mother to carry on with her work when the children were sick.

After housekeeping services were provided during two separate emergency periods, Mrs. Orchard wearily reported that there was no use putting in any more emergency help. The only solution she could see was to go home and look after her own children. When she told the doctor she would have to leave the sanatorium he again referred her to the social worker. The patient had had an exhausting series of telephone conversations with her parents. She discovered that the constant pressure to which she was subjected was not so much related to the demands made by the children as to the hostility of her family toward her young husband because of his alleged failure to meet his financial share in the household. The patient was willing to delay leaving, however, until the social worker had an opportunity to see the mother so that together they could evaluate the situation more fully. Subsequently, interviews with the patient's mother confirmed the fact that the parents did feel that they had been burdened long enough by reason of the fluctuating economic circumstances of this young family. The mother, however, was anxious for the patient to stay in the sanatorium and agreed to try again to carry the load.

For the next 3 months Mrs. Orchard was in conflict between immediate fear of the consequences of leaving the sanatorium against medical advice as her aunt had done and her equally strong fear that failure to take over care of her children might result in a permanent break either with her parents or with her husband. She could not bring herself to accept any alternative presented by the social worker—for example, placement of the children—an alternative which the patient quite reasonably rejected, since she now could anticipate discharge from the sanatorium in a few months and she knew, as the social worker did, that an acute shortage of foster homes might well result in placing the children not in foster homes but in a temporary detention facility instead.

Not infrequently the social worker found Mrs. Orchard waiting for her in the morning, after a sleepless night, needing to review the situation and to look again at alternative choices before her. Often, she released her frustration in angry gusts of tears as the social worker led her back to the inexorable pressures on the outside. She recognized that if she grappled with them too soon they might bring her back to the sanatorium again with more disease and with no greater assurance that her children would have the care that she wanted for them.

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Mrs. Orchard's background included marriage at the age of 17, three childbirths and two miscarriages, family separations due to the husband's service in the Army or his efforts to locate work in other parts of the country, and a series of financial and housing crises. It seemed to the social worker that the sanatorium offered this patient a needed refuge and opportunity to store up more than physical energy. When the patient's mother was interviewed in her home, the social worker could well understand why she could not entirely protect the patient from strain, for the mother had on her hands a nine-room house, three adolescent children of her own, a somewhat irresponsible and demanding husband, and a full-time job. She was staggering under this load, but so aware of the events that led to her sister's death from tuberculosis that she could not bear to "let her daughter down" by turning out the Orchard family, as her husband was apparently urging her to do.

Despite the intensity of Mrs. Orchard's conflict, the actual instability of the social situation, and the small extent of her tuberculosis, the doctors, after reviewing the case with the social worker, concluded that it was still important to recommend that she remain in the sanatorium. Her situation on the outside could be expected to make demands on her, physically and psychologically, for which she would need as much strength as she could possibly accumulate in the sheltered situation in the sanatorium.

Some relief was obtained from the tension under which this patient labored both by her interviews with the social worker and by part-time work in the sanatorium which proved to be a happy experience for her. The social service department was able to obtain attractive clothing for her, which her husband could not afford and which she needed for the job in the sanatorium as well as for life on the outside. The patient did manage to stay until discharged by medical authority, and telephone calls received from her after discharge fully confirmed the prediction of doctors and social worker that Mrs. Orchard's life on the outside would not represent a protected situation. The financial, housing, and other crises in which she was involved shortly after her discharge led the social worker to refer her to appropriate social agencies in the community and to enlist their cooperation.

In this case, the patient showed no desire and little capacity to look at her part in the family's failure to establish itself on a sound and stable basis during 5 years of marriage. Her concern was whether or not to leave the sanatorium before the doctors thought she should. Social service directed itself to this immediate concern, helping in practical ways by securing housekeeping aid services, and in intangible ways by giving the patient the opportunity to work out her conflict and by supporting the patient's mother in the important but difficult part she had to play in making it possible for Mrs. Orchard to remain in the sanatorium.

Another important aspect of arranging for the care of children is the necessity of making sure that parents take part in plans for their children. Too often the parent is not consulted until plans have been made and even put into effect and this can only accentuate the feeling that he is being swept aside, considered dead, as he often thinks of it, before his time. Is it possible that some of the traditional attitude toward the outcome of tuberculosis creeps into our point of view so

that we do not fully expect these parents to return to their children or to play a vital part in their lives? And it is not only in the community that this attitude may be detected. Too often, it makes its appearance within the health or medical setting itself. Somehow, traditionally, we have the attitude that the person who is physically unable to carry out his responsibilities is also unable to think about them and to plan to carry them out. Patients need to be protected from too much stress but in our efforts to protect them we sometimes infringe upon their rights and add to their anxiety.

Unless the parents have by legal determination been found unfit to participate in planning for their children, they should be consulted in all important developments in the lives of the children. It is recognized, of course, that practical circumstances will sometimes preclude prior discussion with parents when moves must be made quickly, but these circumstances should be held to a minimum, as much for the sake of the child as for the parent.

Children, too, need to feel their parents' part in their lives, for the sense of belonging and of having a unique place in the parent's affection, so necessary for growth, can scarcely be achieved except by a knowledge of the parent's concern. Parents themselves, as well as others, sometimes forget this, either because they are consciously or unconsciously ready to shed their parental responsibility when they enter the sanatorium, or because in an effort to protect themselves from further emotional stress and pain, they have withdrawn themselves from living on the outside.

Child Welfare Services

Mr. Jordan, who was referred by the rehabilitation counsellor, came to the medical social worker to inquire whether he could receive help in arranging for the care of his little boy. Mr. Jordan was a man of 30, with limited education. His wife had died of tuberculosis the previous year, just before his infection was discovered; a 5-year-old child was admitted to the sanatorium at about the same time and was now a patient there; and the care of his 7-year-old child had been taken over by a cousin.

When Mr. Jordan came to see the social worker, only his low weary voice and dejected posture gave some clue as to how he felt about himself and his situation, for his words seemed to indicate only apology for troubling the social worker. When this situation was presented to the doctor, the social worker commented on Mr. Jordan's concern for himself and the sick child, and his dejection over his own physical condition and inability to assume responsibilities. The doctor pointed out that he thought that Mr. Jordan was over-reacting to his illness.

From an aunt the patient had learned that the cousin who had taken his 7-year-old son into his home had lost his job, and left the city. The family had placed the boy with a childless aunt and uncle, both of whom were employed and could give the boy little supervision and personal attention.

Mr. Jordan told the social worker how worried he was. The situation was referred to the child welfare agency, which placed the boy in a foster home where he would receive adequate care. At the suggestion of the child welfare agency caseworker, Mr. Jordan was encouraged to initiate correspondence with the foster

mother. The child welfare agency caseworker offered to stress the need for keeping before the child his father's concern and plan to reunite the family group as soon as he was well. Correspondence was begun by the patient and was maintained in lively fashion both with the foster mother and with the child for the remainder of the period of Mr. Jordan's stay in the sanatorium.

A channel of communication between Mr. Jordan and his boy was thus quickly established and the immediate problem of child care seemed solved, but the patient continued to come to the social worker to talk of other problems. With help from the medical social worker, and probably for the first time since his wife's illness and death, Mr. Jordan was able to talk of the meaning to him of the experiences of the past 2 years. He had had to give up most of the relationships that made up his life to that point. As he told of his wife's death, the effect on him of his diagnosis of tuberculosis, the separation from each of the children, and his continuing anxiety about himself and the little boy hospitalized in the other building, it was clear that this patient had tried to repress his feelings as best he could in denial of the pain and desolation through which he had passed.

Sharing the pain with someone, he could cease somewhat his constant preoccupation with that phase of his life which included his wife and accept the fact that it represented something to which he could not return. It probably was not mere coincidence that, following the easing of his anxiety about the child and his first talk with the social worker, Mr. Jordan seemed to take heart for the first time and to believe the doctor when he was told he was not as sick as he had feared. He began taking part increasingly in recreation and work in the hospital within the limits of medical advice.

This was particularly interesting as he had previously spoken with the doctor several times but had apparently not been able to absorb and accept favorable news about his condition. He was soon assigned to part-time work in charge of a commissary branch store on his ward. Further problems with regard to the children were brought to the medical social worker and were promptly cleared up with the child welfare agency before they took on large proportions. Following his discharge and the subsequent discharge of his child from the sanatorium, he did reestablish a home for himself and his children.

The community cannot eliminate the deleterious effects of tuberculosis as it bears upon children of sick persons; at best, it can provide resources for minimizing the toll exacted from children when their parents suffer from tuberculosis. Neither the health official nor the medical social service department of the sanatorium can work directly on the problem from the standpoint of the children. Rather, the full array of social services in the community, including child-welfare agencies, day care and institutional facilities, housekeeping-aid services, and family-welfare agencies must be called upon to take their proper share of responsibility in minimizing the impact of tuberculosis on children, in facilitating admission of the sick person to the sanatorium and in assuring some measure of freedom from anxiety for him while he is there. If the community has neither agency resources nor adequate funds for measures such as housekeeping-aid services and foster-home placement and supervision, the conflict placed upon parents with tuberculosis becomes so grave and real that refusal to accept sanatorium care is at times the only responsible

course possible for the parent. Adequate social-service resources, in other words, represent a vital part of tuberculosis control.

In the sanatorium, the social service department can facilitate the use of community resources in the individual case by bringing to the patient a knowledge of appropriate resources in the community which may be called upon, and by communicating with the agencies involved.

The hurt of separation from children, the pain of being a potential source of infection to them, the longing to be a daily participant in their growth and development, these emotional facts are an omnipresent reality in the sanatorium. It is believed and hoped that sharing the hurt and longing, and receiving a deep and honest response of understanding from the medical social worker helps make these emotional facts more bearable for the parents who are patients.

* * * * * * *

A person need not stand alone in his trouble. A sick person who must spend many months in a hospital has many problems. He can be helped to work out his practical problems and the subtle elusive facts of the inner reality in which we find our meanings and our satisfactions in living. He can be helped to resolve his confusion of feelings and facts and find a way of dealing with them so that he can remain in the sanatorium as long as necessary, using his medical care constructively. Eventually he can leave the sanatorium physically and emotionally sustained and sufficiently freed to live with greater inner security and peace with himself and his illness.

ACKNOWLEDGMENT

The writer expresses her gratitude to Dr. Robert J. Anderson and the Division of Chronic Disease and Tuberculosis. That the paper was made possible at all is due to their belief that the experience of the writer in one sanatorium would have significance beyond the immediate locality. To Sophia Bloom, Chief Medical Social Consultant in the Division, sincere appreciation is extended for her generosity in sharing her wide and intimate knowledge of the medical social aspects of tuberculosis; to Marcella Bernstein, Chief, Publications Section, the writer expresses thanks for her valuable editioral assistance.

Although the sanatorium of the paper is unnamed, it is appropriate to acknowledge the writer's indebtedness to its medical staff, especially the superintendent and his associates, for an opportunity to work in a setting in which she could rely upon their support and humaneness. To the patients themselves, the writer can only express a sense of humility and deep gratitude, for from them and with them she came a little closer to knowing what the human spirit can bear.

REFERENCES

(*4*) Bloom, Sophia: Some economic and emotional problems of the tuberculous patient and his family. Pub. Health Rep. **63**: 448–455 (1948).

(*5*) Money payments to recipients of old-age assistance, aid to dependent children and aid to the blind. Bureau Circular No. 17. Bureau of Public Assistance, Social Security Board, Federal Security Agency, March 1944, 31 pp.

BCG Vaccination on a World-Wide Scale

The Joint Enterprise, or International Tuberculosis Campaign, has conducted mass BCG vaccination programs in over 20 different countries in Europe, Asia, Africa and Latin America. An account of these and other ITC activities, now available in this organization's second annual report, deserves wide attention. It will be of value not only to experts concerned with technical problems related to BCG vaccination, but also to anyone interested in the practical day to day working details of an international health program.

Since its earlier report [1] describes at length the history of the ITC, a short introduction merely summarizes organizational relationships and policies. As is now generally known, three Scandinavian relief organizations, recognizing in the late 1940's that tuberculosis had become so widespread in post-war Europe as to create an emergency, began mass BCG vaccination in Hungary, Poland, and Germany. In 1948, the United Nations International Children's Emergency Fund joined with them to create the Joint Enterprise (later called, for purposes of popular understanding, the International Tuberculosis Campaign). With the World Health Organization providing technical guidance and aid, the ITC has aimed to assist countries in the execution of mass campaigns and to introduce BCG vaccination to them as a tool in their long-range tuberculosis control program. As of June 1950, 22,582,792 children and young adults throughout the world had been tuberculin tested and 10,845,455 vaccinated.[2]

The report is divided into two main sections, one dealing with operations at ITC headquarters in Denmark and the other with field activities. A shorter section discusses extensive research studies on BCG vaccine, carried out in Denmark in cooperation with the Danish State Serum Institute and WHO's Tuberculosis Research Office; the final section is devoted to plans for the continuation of BCG work under United Nations' auspices upon the termination of the ITC this summer. Charts and graphs illustrate various points in convenient annexes to the different sections.

The headquarters operations section is composed of reports from ITC's director and its departments: finance, BCG laboratory consult-

NOTE.—A review of the Second Annual Report of the International Tuberculosis Campaign, July 1, 1949–June 30, 1950, issued by the International Tuberculosis Campaign. Copies may be obtained from the International Tuberculosis Campaign, Svanemollevej 25, Copenhagen, Denmark.

[1] The Conference on European BCG Programmes. Conducted with the assistance of the Joint Enterprise, Copenhagen, Denmark, September 8–12, 1949. Issued by the International Tuberculosis Campaign.

[2] These figures include pre-ITC work under Scandinavian auspices only. As of May 31, 1951, a little over 37,000,000 people had been tuberculin tested and 16,447,934 vaccinated.

ant, field personnel, public relations, statistics, field supply service, and motor transport. All administrative details are competently presented and from a refreshing point of view. As the director, Dr. Johannes Holm puts it: "The Headquarters of the ITC is not a 'master mind' for the programmes but a 'home base' through which solutions are found to the practical problems which assure efficient conduct of the campaigns * * * ITC.HQ staff in fact, do not regard themselves as a *head*-quarters with responsibility only for formulating policy, issuing directives, and controlling to ensure that these are followed, but as an integral working part of the field operations." He points out that there is no major ITC staff officer who has not actually participated in field work and faced immediate problems in his particular area of responsibility.

Reports forming the field operations section were prepared by headquarters personnel rather than by officials in individual countries (as they were in the first annual report). Fear is expressed that in this way "local color" is sacrificed to uniformity and standardization of material. Nevertheless, a wealth of human detail is included. Accounts of the "counter propaganda" campaigns in Egypt and India, for instance, make highly interesting reading. So also do the pages concerning situations encountered in North Africa where most of the people are nomads, and few can read or write, where the principle of authority is strong, and it is usually necessary to vaccinate in the open air. The campaigns in each of the countries are described, and details are given, with some variation, on (1) developments prior to the ITC phase; (2) the campaign itself; (3) practical organization of day-to-day work; (4) techniques of tuberculin testing and BCG vaccination; (5) statistics; (6) retesting (if any); (7) plans for continuation by the government upon completion of the ITC phase; and (8) general remarks.

The report likens progress in the management of mass BCG vaccination campaigns to the development of the airplane. "It must be stated that when the Danish Red Cross started its mass BCG vaccination campaigns in Europe in 1947, the plane was a 1918 model monoplane. Perhaps the four-motored Constellation of BCG mass campaigns has not yet been reached. However, ITC staff feel that they are on the right track." Many problems have arisen in the day-to-day campaign work, as they did during the airplane's evolution, through constant experience under varying conditions. These have had to be attacked by special studies, some in the field, others under separate, controlled conditions.

Many interesting details of problem solving are given. For example, experience has proved that paramedical personnel, like medical students or nurses, who lack extensive medical experience and are most likely to follow instructions without individual inter-

pretation, carry out tuberculin testing and BCG vaccination most satisfactorily. "The most unreliable category for such work, paradoxically, is the highly specialized doctor." In ITC's first year a working team was composed of one doctor and two nurses, but this has been modified and now varies somewhat from country to country. The most successful way of organizing a campaign, the report states, is to have all, or many of the teams, concentrated in one area at a time to finish their work before moving on.

Teams were instructed to use thermos flasks for transporting vaccine from place to place in the field, after its arrival in special refrigerated containers. ITC.HQ devised a wooden block in which one ampule could be held during work so that sunlight might not have a deleterious effect. A single prevaccination tuberculin test, the Mantoux, has been arrived at, with the Pirquet and Moro patch tests used only under special conditions. Originally a distinction was made between over-all and demonstration campaigns, but later it was only possible to separate two phases of the same campaign: that of demonstration and instruction and that in which it was no longer necessary for international medical personnel to take part in the actual vaccination work. The first demonstration phase, it was found, should never be too brief.

Over-all plans for the campaign in a country, ITC has learned, should be developed at least several months before actual work begins. These plans should be worked out with national health authorities and the vaccinating staff well in advance, nationally as well as in the first districts to be covered. All doctors should be completely informed and community leaders contacted and given information for dissemination. Interestingly enough, planners of community X-ray surveys in the United States [3] have found, in the same way, that it is advisable to conduct presurvey studies months or even longer in advance of actual X-ray operations. Moreover, a great deal has been done to arouse public interest before any of the units are in operation. For some 6 weeks before X-raying begins, the survey has been written up in the press, talked about on the radio, perhaps announced in theatres.

ITC has also found that the local press and public information resources must be exploited. Mobile loud speakers are most useful, particularly in countries where there is high illiteracy. Wherever possible, ITC missions have first carried out vaccination in the schools, thus ensuring that information about the vaccination and tuberculosis in general would spread to the great majority of homes. "Experience from many programmes," (in schools), says the report, "has shown that positive consent forms impede the work considerably and should not be used. Parents should not be asked to give positive consent

[3] Community-Wide Chest X-ray Surveys, I. Pub. Health Rep. 65: 1277–91 (1950).

to the tuberculin testing or vaccination of their children. Where some parental acknowledgment is deemed essential a negative consent form should be used."

To American readers, the material on tuberculin sensitivity given in the report is perhaps of greatest interest. During these ITC campaigns for the first time in history, tuberculin testing and vaccination have been carried out on a broad international scale with practically uniform material, uniform techniques, and with personnel who had received substantially uniform instruction. The report emphasizes, however, that it would be unwise to draw direct conclusions about a country's general tuberculosis problem from its percentage of reactors alone, since "a number of factors will influence the percentage of reactors in a population." Examples of these factors include the amount of cattle tuberculosis, the degree to which infectious cases have been isolated, the general living habits, and the housing habits of the population.

Tuberculin sensitivity data given in the report are considered preliminary and presented with reluctance. The more comprehensive country statistical reports, already issued for Czechoslovakia [4] and Poland [5] and forthcoming for other countries will provide indices of tuberculosis infection which will be comparable and therefore of international as well as national value. However, statistical summaries of the work done are given and these indicate that tuberculin sensitivity is, in general, high in Poland (tested: 5,514,036; reactors: 2,512,321) or Ceylon (tested: 32,639; reactors: 20,827) or Hungary (tested: 3,095,146; reactors: 1,903,412), while it is relatively low in Austria (tested: 739,699; reactors: 147,822) or Greece (tested: 1,102,489; reactors: 237,819). "It is difficult to select representative statistics," the report points out, "until the campaigns are completed and a thorough analysis has been made of the figures and bias factors in each country."

In Greece, for instance, because of wartime and geographic conditions, only about half the number to be reached in each district was tested. In Austria the number tested was far from the total rough target, but the number of school children tested is not far from the total number of school children, province by province. Percentages of tuberculin reactors by age and by district are charted graphically for each of ten separate countries. Average percentages for all the countries studied, in easy-to-read table form, however preliminary, would have added to the usefulness and interest of the document.

[4] "Mass BCG Vaccination in Czechoslovakia 1948–49." Prepared by the Tuberculosis Research Office, World Health Organization, Copenhagen. Published by the International Tuberculosis Campaign, August 1950.

[5] "Mass BCG Vaccination in Poland, 1948–49." Prepared by the Tuberculosis Research Office, World Health Organization, Copenhagen. Published by the International Tuberculosis Campaign, December 1950.

Statistical summary of ITC campaigns, country totals [1]

Country	Grand total including pre-ITC work under Scandinavian auspices only		
	Tested	Reactors	Vaccinated
Austria	739, 699	147, 822	507, 541
Czechoslovakia	3, 421, 876	1, 036, 656	2, 088, 446
Finland	1, 322, 000	(2)	592, 523
Greece	1, 102, 489	237, 819	756, 395
Hungary	3, 095, 146	1, 903, 412	1, 081, 391
Italy	50, 401	14, 902	28, 636
Malta	54, 968	9, 962	38, 770
Poland	5, 514, 036	2, 512, 321	2, 535, 026
Yugoslavia	2, 398, 743	822, 614	1, 262, 764
Arab Refugees	211, 323	25, 751	148, 137
Egypt	297, 499	118, 714	82, 129
Israel	296, 821	75, 737	176, 772
Lebanon	43, 463	5, 354	28, 311
Syria	166, 676	41, 790	75, 386
Algeria	545, 731	188, 263	185, 297
Morocco	1, 198, 066	[3] 127, 045	566, 836
Tangier	21, 089	8, 771	7, 493
Tunisia	274, 649	82, 748	123, 757
Ceylon	32, 639	20, 827	5, 641
India	1, 563, 673	767, 165	485, 045
Pakistan	231, 805	99, 868	69, 159
Total	22, 582, 792	8, 247, 541	10, 845, 455

[1] Second Annual Report of the International Tuberculosis Campaign, p. 139.
[2] Data not available.
[3] Incomplete data.

It is not made clear just how ITC's work will be carried forward, nor under what auspices. In any case, this general report, combined with the more comprehensive reports from each individual country, will form a valuable permanent record of mass BCG campaigns carried out on an unprecedented scale and provide data on the epidemiology of tuberculosis such as have never been available before. It gives the broad background which should greatly aid in drawing conclusions as to the protective value of BCG mass vaccination.

Errata

In the article, "Research Contributions of BCG Vaccination Programs. I. Tuberculin Allergy as a Family Trait," PUBLIC HEALTH REPORTS, vol. 66, pp. 259–276, March 2, 1951, the following corrections should be made: On page 268 replace the s_T in first formula by s_T^2. Footnote 2 on the same page should be as follows: "The degrees of freedom for $\overline{s_1^2}$ was 732−84=648 (number of families with a reduction of 1 for each school), and the degrees of freedom for $\overline{s_2^2}$ was 1,739−732=1,007 (number of siblings with a reduction of 1 for each family)."

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended August 18, 1951

Virginia reported 22 cases of malaria for the current week, the largest number reported for any week this year in that State. From January 1 to August 11, inclusive, a total of 47 cases was reported; and for the first 8 months of 1950, there were only 10 cases. Of 33 cases reported in the 6-week period ended August 11, 1951, 28 were said to be among military personnel. Twelve of the latter were reported from Fairfax County, and 6 from Prince Georges County.

One case of human rabies was reported in each of two States—Indiana and Tennessee—for the current week.

Wisconsin reported one case of smallpox.

The total number of new cases of poliomyelitis was 1,765 for the current week as compared with 1,521 for the previous week, or an increase of 16 percent. Last week a 26-percent increase over the previous week was noted.

Three geographic regions—New England, East South Central, and the Mountain States—reported slight decreases in the numbers of poliomyelitis cases for the current week as compared with the previous week. The South Atlantic and Pacific States reported increases of only three and six cases, respectively. Of the remaining States, only the West North Central States showed a substantial increase in the number of cases for the current week, 242 as compared with 138 for the previous week. In this group of States, Minnesota, Iowa, Missouri, and Kansas accounted for the large increase. Although all States in the East North Central area reported increases over the previous week, numerically they were not great.

The cumulative total since the seasonal low week late in March is now 8,908 as compared with 9,090 in 1950 and 16,374 in 1949. The cumulative total since January 1 is 10,120 as compared with 10,221 and 17,287, respectively, for similar periods of time in 1950 and 1949.

Epidemiological Reports

Gastroenteritis

Dr. John Kazutow, Maine Department of Health and Welfare, has reported a family outbreak of gastroenteritis in which it was

suspected that sandwiches made from commercially canned chicken and commercially prepared mayonnaise were the vehicle of infection. About 4 hours after eating the food, all four members of a family became ill. When opened, the canned chicken did not show evidence of spoilage. No laboratory confirmation of a definite etiological agent was obtained.

Measles-like Infection

Dr. V. A. Getting, Massachusetts Commissioner of Health, has reported a widespread outbreak of a disease in eastern Massachusetts during the past weeks which superficially resembles measles. However, coryza, photophobia, and koplik spots have not been observed, and the usual posterior cervical gland involvement of rubella is also lacking. It does not resemble scarlet fever, and occurs in older children which appears to rule out roseola infantum. Clinicians have not been able to make a definite diagnosis of the ailment.

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Aug. 18, 1951	Aug. 19, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	1	-------	-------	(1)	(1)	(1)	(1)	45	29	33
Diphtheria (055)	36	65	121	27th	263	387	698	2, 271	3, 515	5, 308
Encephalitis, acute infectious (082)	23	21	19	(1)	(1)	(1)	(1)	632	516	379
Influenza (480–483)	254	337	337	30th	736	1, 107	923	116, 791	139, 871	129, 524
Measles (085)	1, 402	979	979	35th	495, 453	305, 774	584, 297	466, 752	286, 644	549, 351
Meningitis, meningococcal (057.0)	55	58	55	37th	3, 832	3, 555	3. 454	2, 871	2, 642	2, 482
Pneumonia (490–493)	462	708	(2)	(1)	(1)	(1)	(1)	46, 067	60, 689	(2)
Poliomyelitis, acute (080)	1, 765	1, 488	1, 488	11th	[3] 8, 908	9, 090	9, 090	[3] 10,120	10, 221	9, 743
Rocky Mountain spotted fever (104)	21	26	27	(1)	(1)	(1)	(1)	254	348	410
Scarlet fever (050) [4]	260	239	342	32d	260	239	342	53, 646	40, 409	57, 884
Smallpox (084)	1	1	1	35th	18	45	71	10	25	50
Tularemia (059)	17	11	18	(1)	(1)	(1)	(1)	445	642	672
Typhoid and paratyphoid fever (040, 041) [5]	177	102	131	11th	1, 316	1, 604	1, 757	1, 751	2, 114	2, 242
Whooping cough (056)	1, 039	2, 353	2, 129	39th	69, 346	107, 941	90, 561	47, 744	86, 405	64, 543

[1] Not computed. [2] Data not available. [3] Deductions: Michigan, week ended Aug. 4, 2 cases—week ended Aug. 11, 5; Arkansas, weeks ended June 9 and Aug. 11, 1 case each. [4] Including cases reported as streptococcal sore throat. [5] Including cases reported as salmonellosis.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Aug. 18, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	36	23	254	1,402	55	462	1,765
New England	1	1	1	167	3	8	59
Maine			1	27			6
New Hampshire				3			1
Vermont				22	2		6
Massachusetts	1	1		88	1		29
Rhode Island				14		1	1
Connecticut				13		7	16
Middle Atlantic	1	10	1	365	7	38	174
New York	1	7	[1]	190	3		103
New Jersey		3	1	118	2	10	22
Pennsylvania				57	2	28	49
East North Central			1	295	11	39	476
Ohio				53	4		95
Indiana				2			29
Illinois			1	73	3	22	151
Michigan				42	2	17	117
Wisconsin				125	2		84
West North Central	3	2		24	4	31	242
Minnesota	2			5	3	10	39
Iowa				3	1		57
Missouri	1	1		1			50
North Dakota		1		5		19	6
South Dakota				2			7
Nebraska				2			21
Kansas				6		2	62
South Atlantic	16	2	115	187	9	71	124
Delaware				1			
Maryland			2	65	1	24	4
District of Columbia				6		14	1
Virginia			107	55		23	14
West Virginia	3			8	3		8
North Carolina	10	1		12	2		23
South Carolina	1		4	3	1	8	17
Georgia	2	1	2	15		2	42
Florida				22	2		15
East South Central	4	3		25	10	51	159
Kentucky				8	2	4	22
Tennessee	2	2		8	3		43
Alabama	2	1		8	3	30	54
Mississippi				1	2	17	40
West South Central	4	2	64	101	5	159	228
Arkansas			22	11		18	34
Louisiana	1		1	2		30	51
Oklahoma	1	1	41	2		8	48
Texas	2	1		86	5	103	95
Mountain	3		47	56	1	28	173
Montana	1		3	19			6
Idaho				5			5
Wyoming				7			4
Colorado			5	7	1	5	82
New Mexico				9		11	4
Arizona	2		39	9		12	19
Utah							50
Nevada							3
Pacific	4	3	25	182	5	37	130
Washington			3	16	1		16
Oregon	1		14	32		6	6
California	3	3	8	134	4	31	108
Alaska						2	
Hawaii				47			

[1] New York City only.

Anthrax: Tennessee, 1 case.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Aug. 18, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	**21**	**260**	**1**	**17**	**177**	**1,039**	**151**
New England	-	**17**	-	-	**9**	**59**	-
Maine	-	2	-	-	7	10	-
New Hampshire	-	5	-	-	-	2	-
Vermont	-	-	-	-	-	2	-
Massachusetts	-	7	-	-	2	36	-
Rhode Island	-	-	-	-	-	-	-
Connecticut	-	3	-	-	-	9	-
Middle Atlantic	**1**	**35**	-	**1**	**12**	**149**	**19**
New York	1	21	-	1	4	51	14
New Jersey	-	7	-	-	1	50	-
Pennsylvania	-	7	-	-	7	48	5
East North Central	**1**	**90**	**1**	-	**4**	**175**	**14**
Ohio	-	30	-	-	2	38	3
Indiana	-	1	-	-	-	10	9
Illinois	1	18	-	-	-	40	2
Michigan	-	30	-	-	1	30	-
Wisconsin	-	11	1	-	1	57	-
West North Central	-	**14**	-	**1**	**5**	**30**	**15**
Minnesota	-	1	-	1	-	4	4
Iowa	-	5	-	-	-	5	6
Missouri	-	2	-	-	4	2	5
North Dakota	-	-	-	-	-	-	-
South Dakota	-	1	-	-	-	4	-
Nebraska	-	2	-	-	-	-	-
Kansas	-	3	-	-	1	15	-
South Atlantic	**16**	**29**	-	**2**	**15**	**183**	**23**
Delaware	-	-	-	-	-	-	-
Maryland	3	1	-	1	1	6	-
District of Columbia	1	2	-	-	-	3	-
Virginia	7	2	-	-	1	31	9
West Virginia	1	4	-	-	-	39	3
North Carolina	4	16	-	-	3	62	-
South Carolina	-	-	-	-	4	1	6
Georgia	-	3	-	1	6	6	5
Florida	-	1	-	-	-	35	-
East South Central	-	**20**	-	**1**	**18**	**45**	**24**
Kentucky	-	2	-	-	9	8	11
Tennessee	-	13	-	1	6	26	2
Alabama	-	4	-	-	-	8	6
Mississippi	-	1	-	-	3	3	5
West South Central	-	**9**	-	**10**	**28**	**225**	**56**
Arkansas	-	1	-	9	9	15	3
Louisiana	-	1	-	-	6	4	[3] 34
Oklahoma	-	-	-	1	2	26	-
Texas	-	7	-	-	11	180	19
Mountain	**3**	**8**	-	**1**	**3**	**91**	-
Montana	1	-	-	-	-	9	-
Idaho	1	5	-	-	1	3	-
Wyoming	-	-	-	-	-	7	-
Colorado	-	1	-	-	1	29	-
New Mexico	-	-	-	1	-	16	-
Arizona	-	2	-	-	1	27	-
Utah	1	-	-	-	-	-	-
Nevada	-	-	-	-	-	-	-
Pacific	-	**38**	-	**1**	**83**	**82**	-
Washington	-	3	-	-	1	3	-
Oregon	-	2	-	-	1	7	-
California	-	33	-	1	81	72	-
Alaska	-	-	-	-	-	-	-
Hawaii	-	-	-	-	-	-	-

[1] Including cases reported as streptococcal sore throat. [2] Including cases reported as salmonellosis.
[3] Report for June 1 to July 21.

Rabies in man: Indiana and Tennessee, 1 case each.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended August 4, 1951

Disease	Total	New-found-land	Prince Ed-ward Island	Nova Scotia	New Bruns-wick	Que-bec	On-tario	Mani-toba	Sas-katch-ewan	Al-berta	Brit-ish Co-lum-bia
Brucellosis	4	-----	-----	-----	-----	1	3	-----	-----	-----	-----
Chickenpox	385	2	-----	13	-----	39	155	32	20	93	31
Diphtheria	4	-----	-----	-----	-----	2	1	-----	-----	-----	1
Dysentery, bacillary	12	-----	-----	-----	-----	5	4	-----	-----	-----	3
Encephalitis, infectious	1	-----	-----	-----	-----	-----	1	-----	-----	-----	-----
German measles	60	-----	-----	4	-----	9	16	1	13	10	7
Influenza	33	-----	-----	27	-----	-----	-----	1	-----	-----	5
Measles	395	20	-----	30	1	56	43	47	10	139	49
Meningitis, meningococcal	3	-----	-----	-----	-----	-----	1	2	-----	-----	-----
Mumps	159	3	-----	-----	-----	12	74	18	10	20	22
Poliomyelitis	85	1	-----	6	-----	8	60	-----	1	5	4
Scarlet fever	107	1	-----	1	-----	15	18	27	13	16	16
Tuberculosis (all forms)	267	14	-----	6	19	117	23	22	8	46	12
Typhoid and paratyphoid fever	5	-----	-----	-----	-----	4	1	-----	-----	-----	-----
Venereal diseases:											
Gonorrhea	316	11	-----	12	16	66	52	16	40	30	73
Syphilis	94	1	-----	2	1	52	10	2	10	5	11
Primary	9	-----	-----	1	-----	5	-----	-----	3	-----	-----
Secondary	4	-----	-----	-----	-----	2	1	-----	1	-----	-----
Other	81	1	-----	1	1	45	9	2	6	5	11
Whooping cough	135	1	-----	2	2	35	31	12	9	19	24

JAMAICA

Reported Cases of Certain Diseases

4 Weeks Ended June 30, 1951

Disease	Total	Kingston	Other localities
Chickenpox	22	6	16
Diphtheria	4	4	-----
Leprosy	3	1	2
Tuberculosis, pulmonary	77	24	53
Typhoid fever	43	5	38

NOTE.—Week ended June 23 not included in above table. No report for that week was received from Jamaica.

4 Weeks Ended July 28, 1951

Disease	Total	Kingston	Other localities
Chickenpox	21	6	15
Diphtheria	3	2	1
Dysentery, unspecified	1	-----	1
Leprosy	1	-----	1
Tuberculosis, pulmonary	53	21	32
Typhoid fever	59	13	46
Typhus fever (murine)	5	4	1

POLIOMYELITIS IN EUROPE AND AFRICA

Europe. The incidence of poliomyelitis as judged by reports up to July 28, 1951, has been lower in the German Federal Republic, France, Ireland, England, Scotland, Wales, and Sweden than for the corresponding periods, in 1950. However, Austria, Italy, the Netherlands, and Switzerland have reported an increasing number of cases as compared with similar periods for last year. Information has been received that 80 cases of poliomyelitis, with 6 deaths, plus 47 suspected cases have occurred in the Saar region.

Africa. The Belgian Congo continues to report relatively large numbers of cases of poliomyelitis, 54 cases being reported for the 2-week period ended July 28.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently. A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Plague

Venezuela. A total of 7 cases, with 3 deaths, of plague has been reported during the period July 22–August 15, 1951, in the jungle zone of San Pedro County, Miranda State.

Smallpox

French Equatorial Africa. During the period July 21–31, 1951, 13 cases of smallpox were reported as compared with 35 for the previous 10-day period.

French West Africa. During the period July 21–31, 1951, 166 cases (18 deaths) of smallpox were reported chiefly in Sudan (115 cases), Dahomey (23), and Ivory Coast (18). In Dahomey 82 cases (20 deaths) were reported for the period August 1–10.

Indochina. For the week ended August 11, 1951, smallpox was reported in Viet Nam as follows: Hanoi, 44 cases; and Haiphong, 19.

Indonesia. In Surabaya, Java, where 5 cases of smallpox each week were being reported for the past several weeks, a sharp rise has occurred for the week ended August 4, 1951, when 13 cases were noted.

Yellow Fever

Costa Rica. A fatal case of jungle yellow fever has been reported in the Province of Limon. The patient who lived in a wooded area in Guacimo, County of Pococi, became ill on August 11. Three other cases have been reported in this area during recent weeks.

Gold Coast. One suspected case of yellow fever was reported in Accra on August 9, 1951. The patient was from Abetifi Kwahu. Another suspected case was reported on July 30 in the Village of Mfanta near Suhum. The latter patient had visited Akuapim Mampong, where a death from yellow fever had occurred.

The suspected cases of yellow fever reported earlier have been confirmed as follows: Brenase, July 11–12, 2 cases; Kpandu, July 15, 1; and Winneba, July 12, 1. A suspected case reported July 18 in Lartch was not confirmed.

—Announcement—

Courses in Laboratory Diagnosis of Tuberculosis

In cooperation with the Division of Chronic Disease and Tuberculosis, Public Health Service, the Bacteriology Laboratories of the Communicable Disease Center, Chamblee, Ga., will offer two courses in the laboratory diagnosis of tuberculosis November 5–16, and November 19–30, 1951.

The courses are open to all grades of employed laboratory personnel who are approved by their State health officers. Practical laboratory training in all phases of tuberculosis bacteriology, including preparation of culture media, microscopy, cultural procedures, diagnostic use of animals, and testing of drug sensitivity will be included in the course. No tuition or laboratory fees are charged. Reservations for the courses should be made well in advance.

In addition, a similar course will be given for laboratory directors, senior laboratory staff members, physicians, and others of comparable professional standing October 29 to November 2, 1951.

Additional information and applications may be obtained from the Chief, Laboratory Services, Communicable Disease Center, Public Health Service, Chamblee, Ga.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work.

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Librarians and others should preserve their copies for binding, as the Public Health Service is unable to supply the general demand for bound copies. Indexes will be supplied upon request.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON D. C. : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
Price 15 cents. Subscription price $4.75 a year. $6.25 foreign.

Public Health Reports

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FEDERAL SECURITY AGENCY

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Fluoridation Keynoted at Dental Conference

Fluoridation of public water supplies was the central theme of the fourth annual conference of the State Dental Directors, held in Washington, D. C., June 6–8, 1951. The dentist's role in civilian defense occupied another important place on the agenda.

Conferees heard that some communities in nearly every State are already adding fluoride to their water supplies, and many more are considering fluoridation plans. Dentists, both individually and in groups, are taking the initiative in informing the public about fluoridation and in assisting public officials to formulate plans that will meet the need of the specific community.

Each State dental director was given an opportunity to submit questions and problems on fluoridation for discussion at the conference. These topics were placed into four categories: facts about fluoridation . . . the use of these facts with different groups . . . measuring effectiveness of fluoridation . . . technical, financial, and personnel problems.

A group was formed to discuss each of the four aspects of fluoridation. This device insured that specific problems met by the State dental directors in their work would be discussed in relation to similar problems.

Setting the stage for the work of the discussion groups were talks on the promotion and application of water fluoridation, and on the technical engineering phases of the program.

Promotion of Fluoridation

The fluoridation program gives the dental profession its first opportunity to offer a preventive for the mass control of dental caries in a large segment of the population, Dr. Francis A. Bull, director of dental education of the Wisconsin State Board of Health, told the conferees.

Like chlorination, pasteurization, the use of iodine for goiter prevention, and other earlier public health measures, fluoridation is now opposed by some individuals and groups, Dr. Bull pointed out. Their objections can frequently be overcome, however, with facts, he said.

He reported that experience in Wisconsin, where 46 communities

have already added fluoride to their water supplies, has shown the need in many States for:

1. A positive policy on fluoridation by the State dental society and State board or department of health.
2. A State fluoridation committee working in cooperation with the State dental director and the State dental society. In Wisconsin, this group provides data on fluoridation to local dental societies and nonprofessional and official groups. It invites representatives of such groups and the press to State-wide meetings on fluoridation.
3. The leadership of local dental societies in organizing local fluoridation committees and in establishing programs. The local committee should include representatives of community organizations. It can arrange for talks to service clubs, local officials, and PTA's, draw up a sample ordinance, collect information on installation costs in a particular community, and take responsibility for mobilizing popular support for fluoridation.

Fluoridation should not be made the whole dental program; it should be used as a stepping stone to a complete dental health program, Dr. Bull concluded.

Technical Aspects of Fluoridation

Franz J. Maier, senior sanitary engineer of the Division of Dental Public Health, Public Health Service, said that before advocating fluoridation of any particular water supply in a State, the State dental director should be prepared to answer three questions invariably raised:

Will it do any good? Will it do any harm? How much will it cost?

To answer these questions, he added, the director will want to obtain from the State sanitary engineer:

1. The fluoride content of the specific water supply.
2. Estimates of the capabilities of waterworks personnel.
3. Cost of fluoridation based on a detailed study of the water supply.

The fluoride compounds being used by various communities throughout the country, Mr. Maier said, are sodium fluoride, sodium silicofluoride, and hydrofluosilicic acid. Of the three, sodium silicofluoride provides fluoride at about a third of the cost of hydrofluosilicic acid, and at about half the cost of sodium fluoride.

When the community water system delivers more than 12,000 gallons per minute (172,000 population), gravimetric feeders produce the best results, he continued. Volumetric feeders can be used in places delivering less than this amount, down to about 18.6 gallons per minute (267 population). Solution feeders in single units can be used in the smallest installations up to about 1,880 gallons per minute

(27,000 people). Supplies of any size greater than 300 gallons per minute (4,300 people) can be treated with a feeder pumping 22 percent hydrofluosilicic acid.

When the type of feeder and fluoride compound has been determined, the community should submit plans and specifications for the proposed installation to the State health department for approval, he said. The State sanitary engineer will base his approval of the plan and specifications on the following considerations:

1. Adequacy of the proposed equipment.
2. Capabilities of operating personnel.
3. Point of application for fluoride.
4. Extent of safety precautions for protecting operators.
5. Effectiveness of controls to maintain desired fluoride concentration.

Fluoridation Reduces Decay 65 Percent

The discussion groups devoted considerable time to examining the advantages of fluoridation as a means of reducing tooth decay on a mass basis and to the public health aspects of the procedure. It was pointed out that:

+ Studies show 65 percent less dental decay in children born and reared in naturally occurring fluoride areas. There are also more caries-free children.

+ There is an anticipated percentage reduction for all ages of children where controlled-fluoridated water has been used continuously.

+ The present dentist population ratio can more adequately serve the total population as the result of fluoridation programs.

+ Fluoridation is a partial caries-control procedure and does not eliminate the need for other dental health measures.

+ No harmful effects have resulted from fluoridation when the recommended fluoride concentrations are maintained. No ill effects on human beings have been observed. Neither have bad effects been reported by bottlers, brewers, bakers, launderers, gardeners, or industrial users of water.

+ Since water fluoridation is most effective during the years of enamel calcification, it is advisable for those children whose teeth have already been calcified when fluoridation is started to have topical fluoride applications. As the benefits of fluoridated water become effective, topical fluoride applications should be discontinued gradually, beginning with the younger age groups.

Establishing and Evaluating Local Programs

In discussing the establishment and operation of local fluoride programs, the State dental directors emphasized the following points:

+ The public, dentists, and interested municipal officials should be

kept fully informed on the advantages of fluoridation and the techniques for introducing the compounds into public water supplies.

+ The initiation and promotion of the program in a community is the responsibility of the State and local dental societies and the bureau or division of dental health. The establishment of technical standards and procedures is the responsibility of the State departments of health.

+ Total cost figures amortized over 30 years on a per capita basis will average an estimated 5 to 14 cents per person per year.

+ Suitable local plans for a dental health survey before fluoridation and periodic evaluations should be set up by the dental public health program director. The survey should be conducted by local dental personnel.

+ Periodic evaluation of results should be planned so that: (1) progress can be measured; (2) collection of data and of techniques can be standardized; (3) data can aid in motivating the community toward the establishment of a well-rounded dental public health program. Data should be collected to establish age-specific DMF and def rates [1] per 100 children.

+ Age-specific data should be collected for children of ages 5 through 15. In small communities all children should be examined, and in the larger communities a sample of from 200 to 300 children at each age should be examined. In larger cities, it may be desirable, although not necessary, to consider other factors, such as areas of the city, race, or economic level. In that case, the sample size should be 200 to 300 children in each age group for each of the factors to be considered.

+ In order to be able to measure changes in the caries-attack rate after water fluoridation, examinations made at 3- to 5-year intervals following the introduction of fluorides into the water supply are suggested.

The Engineering Phase of Fluoridation

The responsibilities of engineers in assisting communities to plan their fluoridation layouts, in the selection of fluoride compounds and feeders for introducing fluoride into water supplies, and in training personnel to operate equipment and to determine the fluoride content of water were discussed in detail by the State dental directors. Their conclusions included:

+ The engineering phase of the fluoridation of a community's water supply should be carefully considered by competent engineers. Their advice is needed on the best type of feeder, the chemicals to be used, and equipment, installation, and operating problems. The

[1] DMF represents decayed, missing, or filled permanent teeth, and def stands for decayed, extraction indicated, or filled primary teeth.

bureau of sanitary engineering of the various State boards of health must review and approve the plans.

+ Persons capable of operating a water plant, experience has shown, are capable of adding fluorides to the water supply of a community.

+ Orientation and training of water plant operators in testing and safety procedures should be conducted on a continuing basis by the State departments of health.

+ Engineering aspects of fluoridation, such as tests to determine the fluoride content of water and the safety, qualifications, and training of the operator, should be covered by State regulations. The recommendations of the American Water Works Association are acceptable to most State departments of health.

+ The equipment involved in water fluoridation is the same standard type that has been used in water plants for many years and has proved to be reliable through long years of experience. The equipment to be used is an engineering decision subject to approval of State health authorities for any specific installations.

The Dentist in Atomic Warfare

Discussing the role of the dentist in atomic warfare were Colonel W. L. Wilson, assistant administrator for health and welfare of the Civil Defense Administration, and Dr. Arthur C. Bushel, assistant director of the Bureau of Dental Health of New York State.

Colonel Wilson told the State directors:

+ During the initial stages of an atomic disaster, dentists (preferably with hospital experience) should be included in the staffs of hospitals—both existing and improvised types. Primarily, they would care for patients with maxillofacial injuries.

+ Most of the dentists of the community should be assigned, during a period of civilian disaster, to work in first-aid stations. Their professional training should help them to treat shock, arrest hemorrhage, administer plasma, and perform similar lifesaving tasks.

+ Dentists desiring to take training in medical aspects of atomic warfare should contact the Surgeon General of either the Army or the Navy. Courses in this subject are given regularly.

Dr. Bushel noted that:

+ The major problem in atomic disaster is getting the proper supplies and trained personnel to attacked areas with the least possible delay.

+ To help achieve this goal in New York State, the organization for civilian defense is based largely on the principles of decentralization and mutual aid. These principles dictate the need for tremendous numbers of medical workers, with dentists occupying an extremely important place in the organization.

+ As a first step, dentists in New York State have been participating in two-session orientation courses designed to give them a broad picture of the medical problems of atomic disaster and the organizational patterns which are developing at the local level. Dentists trained in this manner should be equipped to act as assistant medical officers, providing essential medical treatment even for those who are seriously injured.

Officers of Association

Officers elected by the members of the Association of State and Territorial Dental Directors at the meeting were Dr. Carl L. Sebelius, Tennessee, president; Dr. James F. Owen, Kentucky, president-elect; Dr. Fred Wertheimer, Michigan, vice president; Dr. William A. Jordan, Minnesota, secretary-treasurer; and Dr. David B. Ast, New York, Dr. William H. Rumbel, Virginia, and Dr. Paul Cook, Louisiana, members of the executive council.

The directors were welcomed to the conference by Surgeon General Leonard A. Scheele of the Public Health Service and Katherine Bain, associate chief for program development of the Children's Bureau. Co-chairmen of the conference were Dr. John W. Knutson, chief of the Division of Dental Public Health of the Public Health Service, and Dr. John T. Fulton, dental services advisor of the Children's Bureau.

Leaders of the discussion groups were Dr. Paul Cook of Louisiana, Dr. Thomas W. Clune of Rhode Island, Dr. H. Shirley Dwyer of New Hampshire, and Dr. James F. Owen of Kentucky. Recorders were Dr. Richard C. Leonard of Maryland, Dr. Paul Sebelius of Tennessee, Dr. Roy D. Smiley of Indiana, and Dr. Floyd H. DeCamp of Florida.

Dr. Herschel W. Nisonger, director of the Bureau of Special and Adult Education of Ohio State University, assisted representatives of the Division of Dental Public Health, Public Health Service, and the Children's Bureau, Federal Security Agency, in planning the conference.

A Quantitative Study of Sanitary Engineering Graduates

By Walter A. Lyon, M. S.*

A considerable proportion of sanitary engineering graduates do not follow the profession. This study was designed to provide adequate data regarding the loss to the profession of these graduates. Without such information, it is impossible to estimate accurately the number of graduates in sanitary engineering needed each year to meet the national demand.

Miller's (*1*) recent study showed that 47 universities and colleges at some time during the period 1910–49 offered undergraduate sanitary engineering curricula or options. From these a sample of 25 institutions was studied. This sample represents 73.8 percent of the sanitary engineering graduates during that 40-year period.

Number of Sanitary Engineering Graduates

There is a broad parallelism between the fluctuations in the number of all engineering graduates, all sanitary engineering graduates, and those sanitary engineering graduates in the sample. Figure 1 illustrates this phenomenon. There are, however, variations in the proportion of sanitary engineering graduates to all engineering graduates. Figure 2 shows the relationship between the number of all sanitary engineering graduates and each 1,000 of all engineering graduates for the period 1920–50. The mean number of sanitary engineering graduates per 1,000 engineering graduates for this 31-year period is 5.77, with a standard deviation of 1.60.

In spite of the growth in number of institutions which offer sanitary engineering options, the number of sanitary engineering graduates has not kept pace with the increase in the number of all engineering graduates. Since the beginning of World War II, the proportion of sanitary engineering graduates to all engineering graduates has been much smaller than during the 13-year period prior to 1941.

Miller showed that the 21 institutions having courses in sanitary engineering during the full 5-year period 1934–39 graduated 3.9 men per institution per year, and that the 33 institutions having courses during the full 5-year period 1946–50 graduated 5.0 men per institution per year. Figure 2 shows that the proportion of sanitary engi-

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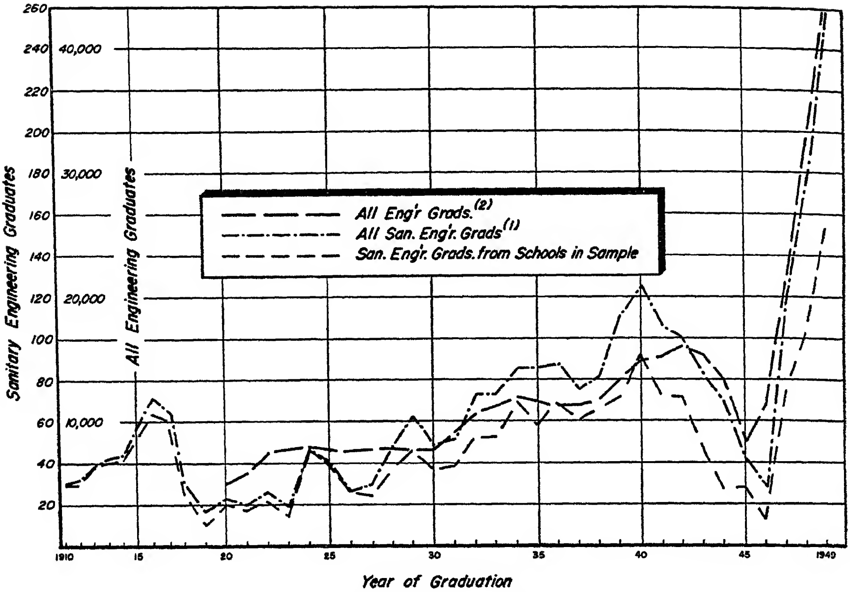

Figure 1. Number of all engineering graduates, all sanitary engineering graduates, and sanitary engineering graduates from schools in sample.

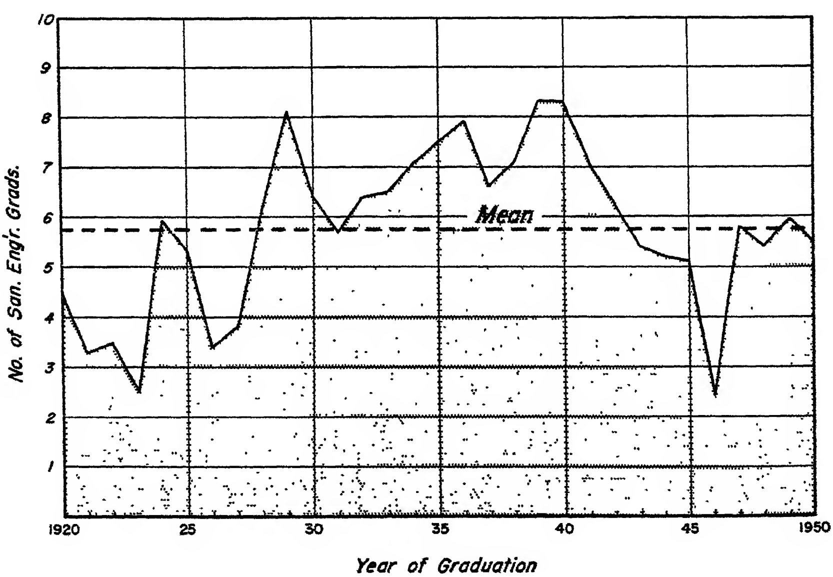

Figure 2. Number of all sanitary engineering graduates per 1,000 engineering graduates, for each year in the period 1920–50 (*1*, *2*).

neering graduates to all engineering graduates has been lower in recent years; actually the average for the 1946–50 period was 32.4 percent lower than for the 1934–39 period. Thus, while there was an increase in the number of institutions offering options, the proportion of sanitary engineering graduates to all engineering graduates has decreased. Should consideration be given to the possibility that sanitary engineering educational efforts are being spread too thin?

Loss From the Profession

In order to obtain information on sanitary engineering graduates, it was first necessary to get their names from the universities and colleges in the sample. Because lists of those who take sanitary engineering options or curricula are rarely kept, the records of all engineering graduates for the 40-year period (or since the inception of the option) were examined to obtain the names of those graduates which could be used in this study.

Although the courses required for the completion of an option may be in an institution's catalogue, these guide lines frequently are not followed. In such instances, it was necessary to apply a minimum criterion to determine whether or not a graduate should be considered as having completed a sanitary engineering option. The minimum criterion was developed by averaging the sanitary engineering content of courses followed by 12 institutions and accepted by a representative group of professors of sanitary engineering to whom it was submitted for criticism. The criterion was designed only as a screening device for this study and is not proposed as an educational standard.

Some of the schools which adhered to the catalogue description of their options did not meet the requirements of the criterion. This points up the problem discussed by Miller regarding the considerable variation in curriculum content for sanitary engineering undergraduates and the difficulty of defining a sanitary engineering graduate.

Having prepared a list of sanitary engineering graduates, it was next necessary to learn the present occupations of the graduates. This was done by examining the records in alumni offices and in the engineering departments of the institutions. Engineering school faculties were also helpful in supplying information. A search of membership rosters of two professional organizations provided additional useful data. When none of these sources furnished the facts required, letters of inquiry were sent to the graduates, and follow-up letters were used if necessary.

In tabulating the information, a graduate was considered to be in the profession if, during the year 1950, he was active in an occupation involving the application of engineering knowledge to the control of

the environment in order to promote and protect the public health in administrative, promotional, operational, teaching, testing, design, or research activities; or he was a graduate student in sanitary engineering. In the case of city engineers, consulting engineers, and those engaged in other broad types of professional engineering activity, a graduate was considered to be in the profession if 50 percent or more of his work appeared to be devoted to sanitary engineering.

Minimum Criterion

*Semester hours**	*Subjects*
2–4	Broad aspects of sanitary engineering, such as: Environmental health. Sanitation science. Public health.
6–8	Water and sewage: Treatment. Design. Collection. Storage. Distribution.
2–4	Sanitary engineering laboratory (water and sewage) analysis; or Bacteriology laboratory; or Quantitative analysis.
2–4	Related science, such as: Microbiology of water. Bacteriology. Industrial hygiene. Insect control. Rodent control. Sanitary inspection. Chemistry (beyond freshman chemistry). Sanitary engineering seminar.
1–2	Related field, such as: Geology. Soil mechanics. Hydrology. Municipal engineering. Advanced hydraulics or fluid mechanics. Sanitary structures.

*17 credit hours should be considered the minimum for the 2-semester year, and 26 credit hours for the 3-term year.

From a total of 1,959 sanitary engineering graduates in the 40-year period from the universities and colleges studied, the necessary information was obtained from 1,782, or 91.0 percent. Table 1 shows in detail for each institution the data collected on its sanitary engineering graduates.

For the purpose of this study, the percent of graduates remaining in the profession is defined as the percent of those who were alive in

Table 1. *Summary, as of 1950, of information on sanitary engineering graduates from 25 universities and colleges, 1910–49*

School	In profession		Out of profession		Dead		Unknown		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
California, University of	104	44.3	100	42.6	7	3 0	24	10.2	235
Cornell University	31	35 2	40	46 6	11	12.5	6	5.7	88
Florida, University of	10	100 0	------	------	------	------	------	------	10
Georgia Institute of Technology	14	100 0	------	------	------	------	------	------	14
Illinois, University of	79	42 5	59	31.7	24	12.9	24	12 9	186
Iowa, State University of	75	50 0	48	32.0	2	1.3	25	16 7	150
Kansas, University of	43	63.2	19	27.9	3	4.4	3	4.4	68
Kentucky, University of	2	40.0	2	40.0	------	------	1	20.0	5
Louisiana State University	5	100.0	------	------	------	------	------	------	5
Maine, University of	24	30 4	48	60.8	2	2.5	5	6.3	79
Massachusetts Institute of Technology	98	39 5	128	51.6	12	4.8	10	4.0	248
Michigan College of Mining and Technology	9	29.0	22	71 0	------	------	------	------	31
Michigan State College	27	60.0	15	33.3	1	2.2	2	4 4	45
Michigan, University of	78	33.5	96	41.2	26	11.2	33	14.2	233
New York University	26	31.3	33	39.8	1	1.2	23	27.7	83
Oregon State College	38	67.9	18	32.1	------	------	------	------	56
Pennsylvania State College	68	44.7	55	36.2	18	11.8	11	7 2	152
Purdue University	42	40.8	54	52.4	4	3.9	3	2.9	103
Rensselaer Polytechnic Institute	1	100.0	------	------	------	------	------	------	1
Rutgers University	18	64.3	8	28 6	1	3.6	1	3.6	28
South Carolina, University of	1	50.0	1	50.0	------	------	------	------	2
Texas, University of	10	43 5	10	43.5	1	4.3	2	8.7	23
Utah State Agricultural College	2	100 0	------	------	------	------	------	------	2
Virginia Polytechnic Institute	30	49.2	27	44.3	------	------	4	6.6	61
Wisconsin, University of	25	49.0	26	51.0	------	------	------	------	51
Totals	860	43.9	809	41.3	113	5.8	177	9.0	1959

1950 and for whom the information was available. In other words, those who have died and those for whom no information could be obtained have been subtracted from their graduating classes to obtain the denominator for the percent figure for each year. Thus, the "percent of graduates remaining in the profession" for the schools sampled for the 40-year period was:

$$\frac{860}{860+809}\times 100=51.5 \text{ percent}$$

The "percent of graduates remaining in the profession" in 1950 for each year of graduation is shown in figure 3. This graph appears primarily to reflect the interplay between the demand and supply of graduates. General economic conditions as well as the effect of two wars which occurred in this period have influenced this interplay. The high percentages in the period 1946–49 are probably due to the recency of graduation in those years. The jaggedness of the graph is characteristic of a study in which relatively small numbers are used.

To summarize the "percent of graduates remaining in the profession" for the 40- and 10-year periods, table 2 has been prepared by averaging the annual "percents of graduates remaining" for certain periods.

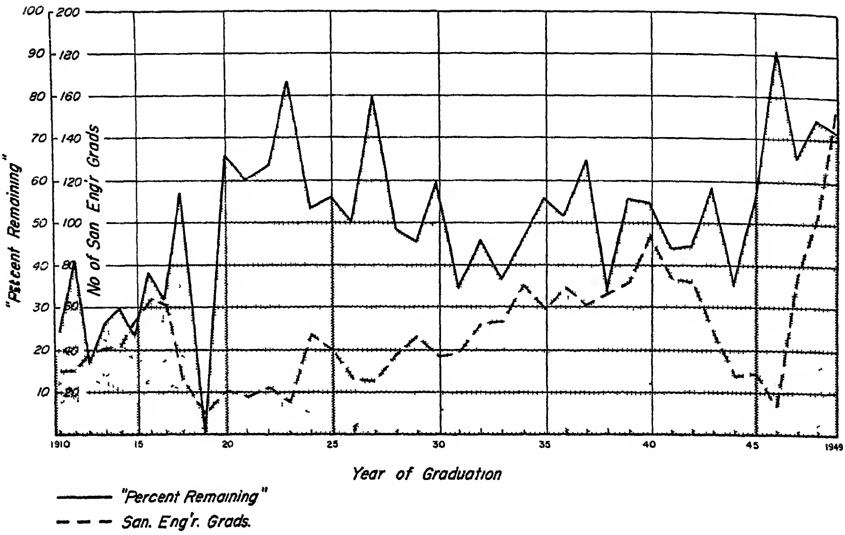

Figure 3. Sanitary engineering graduates from schools in sample and "percent remaining in profession" in 1950, for each year, 1910–49.

Table 2. *Percent of sanitary engineering graduates from selected classes remaining in the profession in 1950*

Years of graduation	Mean percent	Standard deviation
1910–19	29.1	14.3
1920–29	60 7	12 2
1930–39	48.3	10.3
1940–49	59.6	15.1
1910–49	49.4	18.4

The data in table 2 are indicative only of trends on how the profession absorbed the graduates of certain periods. They show that there is still in the profession a slightly greater percent of those who graduated in the 1920–29 period than of those who graduated in the last 10-year period, 1940–49. Probably, many of those who graduated during the genesis of sanitary engineering moved quickly into important positions and have consequently remained in the profession.

As in any other type of social research, there are many factors which interact to produce the statistical picture that is found. One of the primary factors which appears to determine the loss from the profession is the condition of the job market at the time of graduation. At that time the graduate is confronted by a gamut of opportunities in the entire field of civil engineering. Unless he has a particular urge to do sanitary engineering work, the graduate will undoubtedly make his choice after considering the professional and financial attractions of all the available openings. Thus, the loss

from the profession tends not only to be influenced by opportunities in sanitary engineering, but also is determined by the competition within the job market for junior engineers irrespective of specialties. Another factor of some importance is the ability of the university, government, and professional organizations to present the prospective graduate with a sufficient amount of information on the availability of jobs within the field of sanitary engineering.

Answers supplied by the respondents to our inquiries indicate that a number of graduates pursue the profession of sanitary engineering for a period of years and then move to more remunerative jobs in other branches of engineering. There was little evidence that graduates returned to the profession after having once left it.

A comparison of the sizes of graduating classes by institution for the years 1947–49 with the loss from the profession revealed no relationship.

Outlook for the Future

With the assumptions that peacetime conditions will prevail, that the mortality rate among students will be average, and that there will be no losses under the Selective Service rules, the Office of Education has estimated (*2*) the total number of engineering graduates for the years 1951–54. By applying to these figures the mean number of sanitary engineering graduates per 1,000 engineering graduates during the last 31 years, we obtain an estimate of the number of sanitary engineering graduates that might be expected. An appraisal of the number of graduates who could be expected to devote a considerable proportion of their working lives to the profession can be obtained by applying to the last figure the 40-year mean "percent remaining in the profession." This percentage, since it covers a 40-year period, is an index of the proportion of the past sanitary engineering graduates who are spending a significant part of their working lives in sanitary engineering.

Table 3. *An estimate of future production of sanitary engineering graduates*

Year	Estimated number of all engineering graduates	Estimated number of sanitary engineering graduates	Estimated number of sanitary engineering graduates who will follow the profession
1951	38,000	219	108
1952	26,000	150	74
1953	20,000	115	57
1954	17,000	98	48
Total	101,000	582	287

Assuming normal college enrollment rates, the Office of Education

estimates (*2*) that the total number of engineering graduates will remain at the 17,000 level until 1961. After that year the number of engineering graduates is expected to rise again.

Of the 838 sanitary engineering graduates in the 4-year period 1947-50, an estimated 540 entered the profession. Sanitary engineering appears to have arrived at just the age when losses due to retirement and deaths are becoming increasingly felt. These vacancies will have to be filled in addition to the needs created by the natural growth of the profession's activities in this country and by expanding responsibilities in the international field.

This discussion has been limited to men who have completed undergraduate sanitary engineering curricula or options. Many of these graduates have gone on to postgraduate courses in sanitary engineering, as have others who have had no undergraduate sanitary engineering education. Some who have had an education in other branches of engineering have successfully engaged in professional sanitary engineering work. All of these make up the group which represents the sanitary engineering profession today.

Summary

A quantitative study has been made of sanitary engineering graduates from undergraduate options and curricula in the United States. Those graduating in the 40-year period 1910-49 were considered. A 73.8-percent sample of those who graduated during that period was included in the study.

It was found that 51.5 percent of that group was active in the profession in 1950. A discussion of the more detailed statistical information is presented, and an estimate of future production is made.

ACKNOWLEDGMENTS

Thanks are due to those members of the engineering faculties of the universities and colleges who assisted in this study. Particular thanks are extended to Sanitary Engineer Director Arthur P. Miller, Public Health Service, under whose guidance this study was carried out.

REFERENCES

(*1*) Miller, Arthur P.: Graduates from undergraduate sanitary engineering courses in the United States. Pub. Health Rep. **66:** 369 (1951).

(*2*) Armsby, Henry H., Associate Chief for Engineering Education, Division of Higher Education, Office of Education, Federal Security Agency. Personal communication.

Education and Utilization of Sanitary Engineers

The second meeting of representative persons concerned with the education and utilization of sanitary engineers was held in Washington, D. C., April 8 and 9, 1951, under the sponsorship of the Division of Engineering Resources, Public Health Service. This group of 34 men—representing universities and colleges, Federal, State, interstate, and local health agencies, industry, and other interests—presented their views on subjects related to the sanitary engineer's education and his employment status. Agreement was reached on a number of topics as set forth below:

1. Information of value was revealed by the Public Health Service study on the rate of loss from the sanitary engineering profession of men educated in undergraduate sanitary engineering courses. To increase its usefulness, it is desirable that the Service try to determine:

(a) Whether or not similar data are available for other branches of engineering to permit comparison;

(b) The reasons behind this rate of loss among graduates from undergraduate work and conversely the incentives causing those who remain to enter the field and to stay in it;

(c) Similar data for those who have continued their education and have been awarded the master's or doctorate degree;

(d) The incentives impelling those not educated primarily in sanitary engineering to practice in the sanitary engineering field.

2. It is desirable that the Public Health Service make studies to determine:

(a) To what extent licensing as a professional engineer is required by Federal, State, and local merit systems as a prerequisite for employment in sanitary engineering jobs;

(b) The number of men employed by Federal, State, and local health departments who are licensed.

3. Endorsement was given to the principle stated at the January 1950 meeting [1] concerning the desirability of a study of the need for sanitary engineering personnel in all areas of work where engineering disciplines might contribute to the promotion of health. Particular emphasis was placed on the desirability of obtaining data on the abstract (ideal) need and the actual need.

4. Training and orientation of groups of engineers inducted into

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Report from the Division of Engineering Resources, Bureau of State Services, Public Health Service.

[1] Reprint No. 3004 from the Public Health Reports, March 17, 1950.

the Public Health Service in case of emergency should be conducted by the Public Health Service utilizing university and college facilities and staffs as may be needed and available. The representatives of the colleges and universities present at this meeting were of the opinion that this type of training for a small group, probably to be conducted as a short course of the vocational type for a specific assignment, would not be readily adaptable to the organized operation of a university.

At the close of the meeting, the following motion was unanimously approved:

That this group, which includes 24 members of the American Society of Civil Engineers, request the Executive Committee, Sanitary Engineering Division, American Society of Civil Engineers, to implement that portion of the January 1949 report of the Committee on the Advancement of Sanitary Engineering, which recommends the creation of a joint committee comprised of representatives from selected groups or societies to facilitate the advancement of sanitary engineering.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended August 25, 1951

Poliomyelitis

The total cases of poliomyelitis reported for the current week in the Nation was 1,714 compared with the corresponding total of 1,725 for last week. Since the seasonal low week, 10,380 cases have been reported as compared with 10,513 for the same period in 1950. The cumulative total for the calendar year is 11,561, and for the calendar year 1950, the corresponding total was 11,624.

Of the 9 geographic divisions, 4 showed increases in total reported cases for the current week over the previous week, 4 showed decreases, and 1 showed no change. The Mountain Division increased to a total of 235 cases from 173 last week; the Pacific Division, to 161 cases from 130; the Middle Atlantic Division, to 187 from 174; and the South Atlantic Division, to 127 from 124. The East North Central Division decreased by 84 cases, to 392 from 476; and the West South Central decreased by 35 cases, to 193 from 228. The above data exclude Mississippi from which no report was received for the current week.

States reporting the largest numbers of cases were California, 133; Colorado, 114; New York, 109 (including New York City, 38); and Wisconsin, 107.

The following summary of poliomyelitis in Illinois has been received from Dr. L. M. Schuman:

A polio-like disease has appeared in at least two localities in Illinois—one in Williamson County, in the extreme southern part of the State, with 7 cases reported; and the other in Champaign County, in the east central part, where 85 cases have been reported through August 18. Our attention to this possibly different entity was drawn by the fact of disproportion between nonparalytic and paralytic cases.

In the small and localized outbreak in the southern part of the State, all were mild and nonparalytic, and but one additional case could definitely be called paralytic poliomyelitis. In Champaign County, with a population of 70,578, it is presumed that the incidence is confined to this single county, in view of the extremely few cases of

polio, or polio-like disease, in the contiguous counties. Seventy-seven epidemiological investigation reports have been received for the 85 cases reported, and of these 77 cases so far investigated, 69 are nonparalytic; 4 are spinal paralytic; 2 are bulbar; 1 is bulbo-spinal, and 1 is polioencephalitis. Thus, it may be seen that the nonparalytic cases constitute practically 90 percent of the total. The only fatality reported for either outbreak is the polioencephalitis case in Champaign County.

The disease is extremely mild, rather self-limited and of short duration. Symptoms are predominantly severe—headache, fever (of 101°–102°), nausea, vomiting, and stiff neck. This latter may be transient, as was noted in Williamson County, so that few spinal examinations could be made. However, in Champaign County, every reported case has had a spinal fluid examination and the cell counts have ranged between 20 and 150 cells.

Depending on the stage of the disease, the differentials on the cells have yielded pictures similar to that noted in poliomyelitis, that is, polymorphonuclear leucocytes very early in the disease and a preponderance of lymphocytes later. A few nonparalytic cases have had higher counts, in keeping with the broader ranges noted in poliomyelitis. Prodromata are either abrupt or of the dromedary type. Lymphocytic choriomeningitis or Coxsackie infection have been postulated, but the symptomatology and spinal fluid cellular response has not been typical for the former. Laboratory investigation is proceeding for isolation of the etiologic agent and includes virus studies on the stools and complement fixation tests on paired sera. It is surmised, at this time, that there is a probability of Coxsackie infection, but proof must await laboratory investigations.

Epidemiological Reports

Mushroom Poisoning

Six persons, from ages 11 to 76, became ill August 4 after eating mushrooms picked near a cabin in northern Minnesota. The mushrooms were served at a noon meal. Six persons ate mushrooms and developed symptoms late the same day. Two persons who did not eat mushrooms remained well. All of the patients were hospitalized, and two aged 74 and 76 died on August 7 and 8. Autopsy findings confirmed the diagnosis of mushroom poisoning.

Meningitis

The report of the investigation of suspected infectious encephalitis cases in Richmond, Va., late in July, indicates that they were acute fulminating meningitis. No virus agent has been isolated from any of the materials examined.

Tularemia

Dr. D. S. Fleming, Minnesota Department of Health, has reported four cases of tularemia in persons 11, 12, 14, and 22 years of age. Symptoms were stated to have developed 8 hours to 1 week after the persons were bitten by a young squirrel found in a park. Symptoms were headache, high fever, and swollen glands. Two patients continued having some complaints 3 to 4 weeks later. Treatment with penicillin, aureomycin, and chloromycetin was effective. Agglutination with *Pasteurella tularensis*, initially absent, was demonstrated in blood from 2 to 3 weeks after the biting, to titers of 1:160 in two cases, 1:320 in one case, and 1:640 in one case.

Disease of Unknown Etiology

Dr. B. F. Hamilton, Missouri Director of Health, has reported the occurrence of a disease in Newton County during the past month in which the predominant symptoms are fever, headache, multiple minute throat lesions, and nonsuppurative conjunctivitis sometimes unilateral. Twenty-five cases are known to have occurred, mostly in children. The course of the disease in families suggests that the incubation period is about 1 week. Adenopathy is reported not to be marked, but one child had 56 percent lymphocytes on differential blood count. The disease has not been influenced by therapy.

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Aug. 25, 1951	Aug. 26, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	1	-------	-------	([1])	([1])	([1])	([1])	46	29	34
Diphtheria (055)	65	76	145	27th	328	463	842	2,336	3,591	5,452
Encephalitis, acute infectious (082)	28	18	21	([1])	([1])	([1])	([1])	660	534	407
Influenza (480–483)	329	282	296	30th	1,065	1,389	1,244	117,120	140,153	129,820
Measles (085)	1,110	826	737	35th	[2]496,581	306,600	585,484	[2]467,880	287,470	550,538
Meningitis, meningococcal (057.0)	48	38	42	37th	3,880	3,594	3,496	2,919	2,681	2,524
Pneumonia (490–493)	357	673	([3])	([1])	([1])	([1])	([1])	46,424	61,362	([3])
Poliomyelitis, acute (080)	1,714	1,617	1,617	11th	10,622	10,707	10,707	11,834	11,838	11,155
Rocky Mountain spotted fever (104)	12	21	27	([1])	([1])	([1])	([1])	[4] 265	369	434
Scarlet fever (050) [5]	259	263	341	32d	519	502	683	53,905	40,672	58,110
Smallpox (084)	1	-------	-------	35th	19	46	71	11	26	50
Tularemia (059)	9	21	21	([1])	([1])	([1])	([1])	[6] 455	663	686
Typhoid and paratyphoid fever (040, 041) [7]	93	121	121	11th	1,409	1,725	1,895	1,844	2,235	2,380
Whooping cough (056)	991	1,918	1,789	39th	[8]70,346	109,859	92,350	[8]48,744	88,323	66,332

[1] Not computed.
[2] Addition: Utah, week ended Aug. 18, 18 cases.
[3] Data not available.
[4] Deduction: Arkansas, week ended May 19, 1 case.
[5] Including cases reported as streptococcal sore throat.
[6] Addition: Arkansas, week ended May 19, 1 case.
[7] Including cases reported as salmonellosis.
[8] Addition: Michigan, week ended Aug. 18, 9 cases.

NOTE.—Data exclude figures for Mississippi for week ended Aug. 25, from which no report was received.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Aug. 25, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480-483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490-493)	Poliomyelitis (080)
United States	**65**	**28**	**329**	**1,110**	**48**	**357**	**1,714**
New England	**1**	**1**	----	**148**	**3**	**17**	**56**
Maine	----	----	----	29	----	----	4
New Hampshire	----	----	----	7	----	1	3
Vermont	----	----	----	10	----	----	5
Massachusetts	1	1	----	82	1	----	21
Rhode Island	----	----	----	7	----	1	3
Connecticut	----	----	----	13	2	15	20
Middle Atlantic	**6**	**4**	----	**306**	**12**	**52**	**187**
New York	5	3	(1)	170	7	----	109
New Jersey	----	1	----	88	3	34	32
Pennsylvania	1	----	----	48	2	18	46
East North Central	**5**	**6**	**27**	**231**	**1**	**39**	**392**
Ohio	2	1	----	60	----	----	83
Indiana	1	----	27	4	----	3	27
Illinois	----	2	----	53	----	19	90
Michigan	2	3	----	35	----	17	85
Wisconsin	----	----	----	79	1	----	107
West North Central	**5**	**3**	**8**	**38**	**6**	**17**	**242**
Minnesota	2	----	----	6	1	5	43
Iowa	----	----	----	2	2	----	38
Missouri	2	1	1	8	----	----	55
North Dakota	----	1	3	11	1	6	7
South Dakota	----	1	----	1	----	----	4
Nebraska	1	----	----	1	----	----	32
Kansas	----	----	4	9	2	6	63
South Atlantic	**14**	**1**	**112**	**109**	**7**	**38**	**127**
Delaware	----	----	----	----	----	----	----
Maryland	----	1	----	66	2	10	5
District of Columbia	----	----	1	4	----	9	14
Virginia	1	----	99	15	----	15	10
West Virginia	----	----	----	7	1	----	12
North Carolina	6	----	----	1	1	----	15
South Carolina	4	----	1	1	1	----	11
Georgia	2	----	11	2	----	4	47
Florida	1	----	----	13	2	----	13
East South Central	**12**	**10**	----	**13**	**6**	**3**	**121**
Kentucky	1	----	----	----	2	----	31
Tennessee	5	----	----	8	1	----	36
Alabama	6	10	----	5	3	3	54
Mississippi [2]	----	----	----	----	----	----	----
West South Central	**18**	----	**56**	**61**	**6**	**136**	**193**
Arkansas	2	----	27	7	----	20	36
Louisiana	1	----	1	1	----	12	39
Oklahoma	2	----	28	2	----	14	34
Texas	13	----	----	51	6	90	84
Mountain	**2**	----	**94**	**48**	----	**26**	**235**
Montana	1	----	12	16	----	----	6
Idaho	1	----	----	3	----	----	7
Wyoming	----	----	----	3	----	----	15
Colorado	----	----	2	----	----	11	114
New Mexico	----	----	----	1	----	4	14
Arizona	----	----	80	10	----	11	25
Utah	----	----	----	15	----	----	53
Nevada	----	----	----	----	----	----	1
Pacific	**2**	**3**	**32**	**156**	**7**	**29**	**161**
Washington	----	----	5	27	----	----	17
Oregon	----	----	23	6	1	4	11
California	2	3	4	123	6	25	133
Alaska	----	----	----	----	----	----	1
Hawaii	----	----	----	24	----	----	----

[1] New York City only. [2] Report from Mississippi was not received.

Anthrax: New Jersey, 1 case.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Aug. 25, 1951—Continued

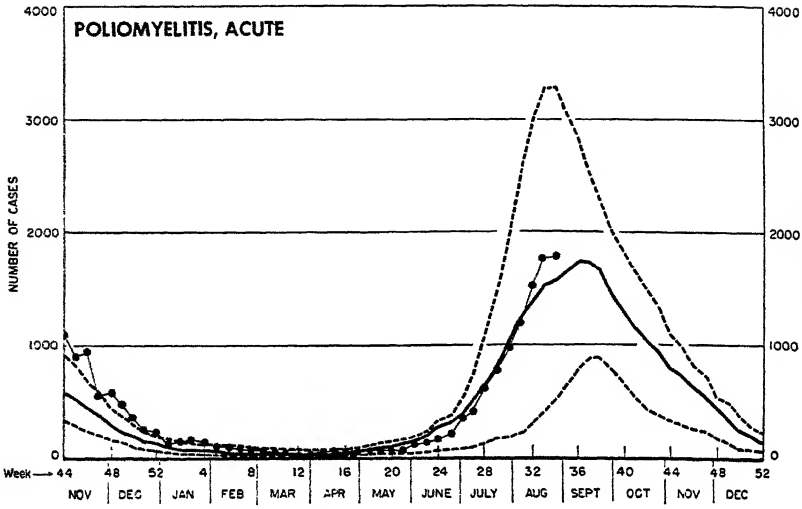
[Numbers under diseases are International List numbers, 1948 revision]

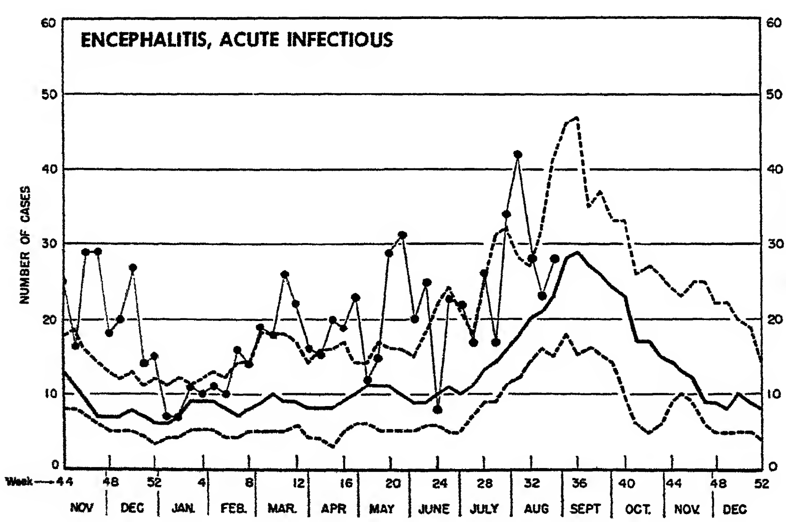
Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	**12**	**259**	**1**	**9**	**93**	**991**	**102**
New England		**22**				**33**	
Maine						12	
New Hampshire		8				2	
Vermont		4				1	
Massachusetts		8				15	
Rhode Island							
Connecticut		2				3	
Middle Atlantic	**1**	**46**			**13**	**173**	**25**
New York		27			4	72	14
New Jersey		8			2	50	
Pennsylvania	1	11			7	51	11
East North Central	**1**	**69**		**2**	**11**	**176**	**9**
Ohio		28			3	42	1
Indiana		6			3	36	4
Illinois	1	8		2	2	23	
Michigan		11			1	40	1
Wisconsin		16			2	35	3
West North Central		**17**		**1**	**4**	**77**	**12**
Minnesota		3			1	4	4
Iowa		2			1	11	4
Missouri		3			1	34	2
North Dakota				1			
South Dakota		2					
Nebraska		1				6	2
Kansas		6			1	22	
South Atlantic	**8**	**25**		**1**	**19**	**134**	**17**
Delaware		1					
Maryland	1	3				5	
District of Columbia	1					2	
Virginia	2	5		1	2	25	10
West Virginia					2	51	
North Carolina	3	11			3	30	
South Carolina	1	2			5		5
Georgia		2			4	14	2
Florida		1			3	7	
East South Central	**1**	**13**			**6**	**66**	**24**
Kentucky		2			2	19	12
Tennessee	1	7			1	37	6
Alabama		4			3	10	6
Mississippi [3]							
West South Central	**1**	**10**		**2**	**22**	**185**	**15**
Arkansas		2		1	2	12	1
Louisiana		4			10	1	
Oklahoma	1	1		1	2	4	3
Texas		3			8	168	11
Mountain		**3**	**1**	**3**	**2**	**60**	
Montana		1		2		1	
Idaho		1				10	
Wyoming		1				8	
Colorado					1	11	
New Mexico					1	13	
Arizona						14	
Utah						3	
Nevada			1	1			
Pacific		**54**			**16**	**87**	
Washington		3			1	14	
Oregon		1				2	
California		50			15	71	
Alaska						3	
Hawaii							

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.
[3] Report from Mississippi was not received.
Rabies in man: Indiana, 1 case.

Communicable Disease Charts

All reporting States, November 1950 through August 25, 1951





The upper and lower broken lines represent the highest and lowest figures recorded for the corresponding weeks in the preceding 5 years. The solid line is a median figure for the preceding 5 years. All three lines have been smoothed by a 3-week moving average. The dots represent numbers of cases reported weekly, 1950–51.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Aug. 11, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	5	----	----	----	----	3	2	----	----	----	----
Chickenpox	211	4	----	3	----	35	88	12	4	44	21
Diphtheria	1	----	----	----	----	----	----	----	----	----	1
Dysentery, bacillary	20	----	----	----	----	3	----	7	----	----	10
German measles	73	----	----	9	----	18	13	2	14	9	8
Influenza	27	----	----	5	----	----	17	3	----	----	2
Measles	334	17	----	17	2	53	53	15	25	82	70
Meningitis, meningococcal	2	----	----	----	----	----	1	1	----	----	----
Mumps	135	3	----	1	----	27	40	3	17	10	34
Poliomyelitis	157	----	----	8	2	29	103	----	10	2	3
Scarlet fever	73	3	----	----	----	12	13	11	8	6	20
Tuberculosis (all forms)	212	15	----	----	11	60	18	16	12	35	45
Typhoid and paratyphoid fever	6	----	----	----	2	4	----	----	----	----	----
Venereal diseases:											
Gonorrhea	316	8	----	5	14	79	45	22	18	43	82
Syphilis	63	2	----	----	4	30	10	3	4	4	6
Primary	4	1	----	----	1	1	----	----	1	----	----
Secondary	1	----	----	----	----	----	----	----	----	1	----
Other	58	1	----	----	3	29	10	3	3	3	6
Other forms	1	----	----	----	----	1	----	----	----	----	----
Whooping cough	117	----	----	2	1	43	43	7	7	6	8

NORWAY

Reported Cases of Certain Diseases—June 1951

Disease	Cases	Disease	Cases
Diphtheria	6	Poliomyelitis	40
Dysentery, unspecified	4	Rheumatic fever	94
Encephalitis, infectious	1	Scabies	463
Erysipelas	317	Scarlet fever	94
Gastroenteritis	3, 917	Tuberculosis (all forms)	357
Hepatitis, infectious	63	Typhoid fever	5
Impetigo contagiosa	1, 277	Venereal diseases:	
Influenza	1, 672	Gonorrhea	165
Malaria	2	Syphilis	51
Measles	2, 197	Other forms	2
Meningitis, meningococcal	8	Weils disease	1
Mumps	102	Whooping cough	1,880
Pneumonia (all forms)	2, 370		

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Plague

Yemen. A total of 13 cases of plague was reported August 1–10, in the rural area of Khawlan. Of the total, 1 case was pneumonic type and 12 cases were bubonic type.

Smallpox

French West Africa. For the period August 1–10, 13 cases and no deaths from smallpox were reported in the Upper Volta.

Ivory Coast. For the period July 1–10, 3 cases of smallpox were reported.

Burma. For the period August 12–18, 8 cases of smallpox were reported from Mergui and 1 case from Rangoon.

India. For the period July 12–18, a total of 34 cases and 2 deaths were reported as follows: Madras 15, Calcutta 8, Bombay 6, Tiruchirappalli 3, Cochin 2 deaths, Tellicherry 1, and Visalshapatnam 1.

Indonesia. For the period July 29–August 4, 24 cases of smallpox were reported as follows: Samarinda 14, Balikpapan 3, Bandjarmasin 2. For the period August 5–11, 5 cases were reported in Surabaya.

French Niger. For the period August 1–10, 30 cases of smallpox were reported.

Indochina. For the period August 12–18, smallpox cases were reported in Viet Nam as follows: Hanoi 31, Nam-Dinh 13, Haiphong 5, and Saigon 1.

Yellow Fever

Costa Rica. Three new cases of jungle yellow fever with two deaths have been officially reported. Numerous dead or dying monkeys in the jungle along the east coast indicate extension of the disease.

Colombia. Three fatal cases of yellow fever confirmed by histological examination have been reported from Colombia. One case occurred in each of three Provinces: Boyaca, Santander, and Caqueta. The three deaths occurred between July 6 and 10.

Gold Coast. For July 26, one case of yellow fever was reported from Dunkwa. The patient was an African male, not inoculated, and is the first case reported from the area.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work.

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Librarians and others should preserve their copies for binding, as the Public Health Service is unable to supply the general demand for bound copies. Indexes will be supplied upon request.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price $4.75 a year, $6.25 foreign.

Public Health Reports

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Preparation of Dried Antigen and Antiserum for the Agglutination-Inhibition Test for Virus Influenza

By M. R. HILLEMAN, Ph.D., E. L. BUESCHER, Captain, M. C. and J. E. SMADEL, M. D.*

Army Area and Medical General Laboratories of the United States Army were supplied with influenza diagnostic antigens in liquid form between 1946 and 1948. Such materials were not completely satisfactory because their keeping qualities were somewhat variable and unpredictable. The stability of influenza virus hemagglutinin on desiccation (*1*) has been utilized in the preparation of a satisfactory dried product which has been used in the Army laboratories since 1948. Detailed information on the preparation and stability of these antigens and their control antisera is presented here.

Preparation of Antigens

The standard type A (PR8), A prime (FM1), and type B (Lee) strains of influenza virus (*2*) supplied by the Influenza Strain Study Center [1] of the Armed Forces Epidemiological Board are used as seed material. Detailed information on the characteristics of these viruses is given in the Catalogue of the Viral and Rickettsial Registry of the American Type Culture Collection (*3*). The seed virus preparations, which are not more than 10 passages removed from propagation in the mouse, are maintained as infected allantoic fluid either stored at −70° C. in sealed glass ampules or dried.

Nine-day embryonated eggs from chickens free of *Salmonella pullorum* infection are inoculated in groups of 50 into their allantoic cavities with 0.4 cc. amounts of a dilution of the appropriate seed virus (usually 10^{-4} to 10^{-5}) which has been found in preliminary titrations to produce chorioallantoic fluids with hemagglutinin titers (*2*)

*From the Department of Virus and Rickettsial Diseases, Army Medical Service Graduate School, Washington, D. C., with the technical assistance of W. O. Blair, S.F.C., A.M.S., and J. R. Hitaffer.

[1] Located at the laboratory of Dr. T. P. Magill, State University of New York Medical Center, 335 Henry Street, Brooklyn 2, N. Y.

NOTE: The trade names appearing in this study are carried as a means of identifying the products under discussion and do not represent endorsement of the product by the Public Health Service.

of 1:320 or greater. After further incubation at 35° C. for 44 to 48 hours, the eggs are candled and the embryos which are still alive are chilled overnight in the refrigerator.

The allantoic fluids, harvested from the eggs remaining from each initial group of 50, are pooled and then heated at 37° C. for 1 hour to assist elution of virus from the small amounts of red blood cells and other particulate matter inadvertently included in the fluids during harvest. They are then centrifuged at 1,000 rpm for 10 minutes in the horizontal machine. Duplicate tubes of standard National Institutes of Health fluid thioglycollate medium (*4*) are inoculated with 1.0 cc. amounts of centrifuged allantoic fluid and then sufficient 1:20 Merthiolate (Lilly) solution is added to the pools to give a final concentration of 1:10,000.

After 5 days storage at 4° C. to await the outcome of the cultural tests, the sterile fluids are selected and warmed to 37° C. in order to redissolve precipitated salts. These are pooled to form the final batch and distributed in 5.0 cc. amounts into sterile Pyrex glass ampules of approximately 10.0 cc. capacity (with inside neck diameter not less than 8 mm.) or into 14 cc. glass bottles (S27AB, T. C. Wheaton Co., Millville, N. J.). After shell freezing in the alcohol-dry ice bath, the ampules or bottles are placed on or in the freeze-drying machine. When the drying process cannot be started at once, the distributed material may be stored at either −20° C. or −70° C. for a period of not longer than 5 days.

Considerable experience has now shown that with the procedure outlined above, the over-all average yield of satisfactory sterile infected allantoic fluid is about 5.0 cc. per harvested egg. It may be necessary to discard as much as 10 percent of the fluid obtained because of positive bacterial cultures and from 1 to 10 percent of the eggs are lost because of death prior to harvest of fluid. The lowest incidences of premature deaths and bacterial contamination are generally obtained during the winter and early spring and the highest incidences during the late summer and early fall.

Preparation of Rooster Antiserum

Pairs of 6–8 lb. roosters are injected both intravenously and intraperitoneally with 5.0 cc. amounts of the appropriate freshly harvested allantoic fluids having hemagglutinating titers of 1:320 or greater. Ten days later, the roosters are bled by cardiac puncture using a 100-cc. syringe or a vacuum bottle with proper connections. Yields of blood of from 80 to 125 cc. are obtained. The clotted blood is cut into pieces approximately 1 cm. in diameter and stored at 4° C. overnight. On the following day, the clotted blood is allowed to stand at room temperature for 4 or 5 hours to promote shrinkage of the clot

and is then centrifuged, and the serum harvested. Usually the volume of the serum is one-fourth to one-third that of the whole blood.

To be satisfactory, antisera must have a titer of 1:800 or more when tested with homologous antigen in the agglutination-inhibition test (see below). Sera with titers of 1:3200 or greater are usually diluted with normal rooster serum to give final titers of 1:800 or 1:1600. The satisfactory sera are inactivated at 56° C. for 35 minutes, dispensed in 0.5 cc. amounts into 5.0 to 10.0 cc. Pyrex glass ampules, plug frozen, and are either immediately placed on the drying machine or stored at −20° C. or −70° C. until dried (within 2 weeks). Approximately 50 to 60 percent of the roosters injected give antisera of satisfactory potency.

It is important to mention in this connection that the roosters used for preparing antisera must be fed a diet containing sufficient amounts of calcium to insure adequate contraction of the blood clot. A satisfactory diet used in this laboratory consists of equal amounts of scratch feed and growing mash and is supplemented by crushed oyster shell and sea sand.

Drying Procedure

Two kinds of apparatus have been used for drying the influenza antigens and antisera. One is a modification of the unit originally described by Bauer and Pickels (*5*) and is intended for use with ampules to be sealed with a torch. This manifold drier was employed in the department for the large-scale drying of Japanese encephalitis vaccine (*6*). The other is a Stokes machine of the chamber type (*7*) designed for drying materials in bottles to be sealed with rubber closures. All influenza diagnostic materials distributed to Army laboratories since 1948 have been dried in the apparatus of Bauer and Pickels; the Stokes equipment has been used only to dry experimental lots of antigen.

Desiccation with the manifold drier is carried out as follows:

The ampules containing frozen antigen or antiserum are chilled with crushed dry ice for an hour and then rapidly loaded on the manifolds which are placed in the refrigerated compartments that have been precooled to about −20° C. The loaded manifolds are promptly connected with the condenser and vacuum pump. When the pressure reaches 30 microns of mercury or less (usually within 3 minutes), the electrical refrigeration of the compartments is cut off. At this point room temperature air is blown into the compartments to elevate the temperature of the ampules and to hasten drying. In a typical run, the pressure gradually decreases to 1 micron or less during the next 8 to 12 hours. After approximately 24 hours, the line to the vacuum pump is closed and super-dry oil-pumped nitrogen (moisture less than 0.002 percent) is introduced into the evacuated system until atmospheric pressure is reached. The nitrogen-filled manifolds are clamped

and removed from the machine and the ampules are sealed with a gas-oxygen torch.

The Stokes drier used in this laboratory is equipped with a dry ice-alcohol condenser and is designed to permit refrigeration of the chamber by circulating cold alcohol through a surrounding jacket. In the present work the alcohol in the jacket is allowed to remain at room temperature.

Bottles of antigen to be dried are chilled in dry ice for 1 hour, rapidly transferred to metal trays, and loaded into the drier. Two pumps are used for initial evacuation of the chamber and when the pressure reaches 50 microns of mercury or less (within 30–60 minutes), one of the pumps is clamped off. In a typical run, the pressure gradually decreases to 10 microns in 6–10 hours and to as little as 2 microns in 24 hours. At the end of 24 hours, the line to the pump is closed and the chamber is brought to atmospheric pressure with super dry nitrogen. The trays of nitrogen-filled bottles are transferred to a hood which is pressurized with super dry nitrogen. Specially dried [2] sterile rubber closures (Corkage S23W, T. C. Wheaton Co., Millville, N. J.) are inserted into the bottles and fastened with triple aluminum seals (Wheaton—20 mm.) using a Wheaton "Roto-Seal" crimping machine (model No. 137). Finally, the seals are thoroughly coated with melted wax (No. 12, Dewey and Almy Chemical Co., Cambridge, Mass.) which provides added protection against moisture.

Hemagglutination Methods

The hemagglutination and hemagglutination-inhibition titrations are performed by a technique which conforms to the standard diagnostic method (*2*) recommended by the Committee on Standard Serological Procedures in Influenza Studies of the Armed Forces Epidemiological Board.

The ampule of dried antigen to be tested is rehydrated with 5.0 cc. of sterile distilled water, care being taken to incorporate all the dried material in the solution. One cc. of the rehydrated antigen is diluted with 19 cc. of physiological saline solution giving a 1:20 dilution of antigen and allowed to stand for 1 hour at room temperature; this facilitates elution of virus from the small amount of particulate matter in the preparation.

To determine the hemagglutinin titer, 0.5 cc. volumes of serial twofold dilutions of antigen in physiological saline solution are mixed in Kahn tubes with 0.5 cc. volumes of a 0.5-percent suspension of

[2] We are indebted to Mrs. B. Towne, E. R. Squibb & Sons, for the general method for preparing the rubber closures. The corkages are washed in Calgonite solution (Calgon Inc., Pittsburgh, Pa.), thoroughly rinsed with tap and distilled water and dried. Groups of 50 stoppers, wrapped in brown paper, are autoclaved at 15 lbs. pressure for 30 minutes. They are then dried for 3 hours at 100° C. over fresh phosphorus pentoxide in a desiccator which is evacuated to 100 microns of mercury or less through a dry ice-alcohol condenser. After drying, the stoppers are stored at room temperature over fresh phosphorus pentoxide.

human red blood cells (type "O"). The pattern of sedimented cells is read after the tubes have remained for 60 to 70 minutes at room temperature. The titer is the highest initial dilution of antigen giving complete hemagglutination.

The agglutination-inhibition titer of serum is determined as follows: The ampule of dried serum is rehydrated with 5.0 cc. of 1:10,000 Merthiolate (Lilly) giving a 1:10 dilution of the original serum. A portion of this is diluted tenfold ($\frac{1}{100}$ of undiluted serum) and 0.25 cc. volumes of serial twofold dilutions of serum are prepared in physiological saline solution. Four units (0.25 cc.) of the desired viral antigen and 0.5 cc. of a 0.5-percent human (type "O") red cell suspension are added to each tube of serum diluted in the range from 1:100 to 1:6400. The pattern of sedimented cells is read after the tubes have remained at room temperature for 55 to 60 minutes; the titer is the highest initial dilution of serum giving complete inhibition of hemagglutination.

Control Tests on Antigens and Antisera

Sterility Tests

Four ampules of dried antigen from each lot are rehydrated with 5.0 cc. volumes of sterile distilled water. One cc. amounts of the rehydrated contents are inoculated in quadruplicate in standard National Institutes of Health fluid thioglycollate medium (*4*). One set of duplicate tests is incubated at 35°–37° C. and the other at approximately 22° C. Two vials of antiserum from each lot are reconstituted with 5.0 cc. amounts of sterile physiological saline solution and tested as described above. Failure of the media to show growth after 10 days' incubation is considered a satisfactory test for sterility.

Tests for Potency and Specificity

These tests are performed on portions of the antigens and antisera rehydrated for sterility testing above. Antigens titering 1:160 or greater (based on the 5.0 cc. volume of allantoic fluid before drying) and antisera with inhibitory titers of 1:800 or more (based on initial volume of 0.5 cc. prior to drying) when tested with homologous antigen are of satisfactory potency. Each antigen is tested for specificity in agglutination-inhibition tests with PR8, FM1, and Lee antisera, and each serum is tested with all three antigens. The PR8 and FM1 antisera when diluted 1:100 or greater should not inhibit Lee antigen nor should Lee antiserum inhibit PR8 or FM1 antigens. Further, the PR8 antiserum should titer at least eight-fold higher when tested with PR8 antigen than with FM1 antigen and vice versa.

Residual Moisture Determinations

Estimations of residual moisture are made on the contents of three separate ampules of antigen selected at random from each lot. Weighing bottles, with inside diameter of 20 mm. or greater and weighing less than 15 gm., are dried at 100°–150° C. in an oven and cooled over fresh phosphorus pentoxide in a desiccator. The bottles are weighed before and after addition of the dried antigen and the weight of sample (45–60 mg.) determined. The residual moisture value is calculated on the basis of weight loss of the sample following exposure at room temperature to fresh phosphorus pentoxide in a desiccator at a pressure of 150–200 microns of mercury for 24 to 30 hours. A balance with five-place accuracy is used for weighing.

Experimental Studies on Stability

Stability of Antigen on Drying and Storage at 4° C.

Table 1 summarizes the results of tests to determine the stability of 21 lots of antigen dried on the Bauer and Pickels machine in glass-seal ampules and stored at 4° C. for periods up to 25 months. The

Table 1. *Stability of dried influenza A and B hemagglutinating antigens on desiccation and storage at 4° C.*

Virus strain	Lot No.	Date dried	Titer [1]		Storage at 4° C.	
			Before drying	After drying	Period (months)	Titer
PR8	1A	August 1948	320	[2] 320	25	160
	1B	do	320	320	25	320
	3A	July 1949	640	320	13	320
	3B	do	640	320	13	640
	4A	August 1949	640	320	13	640
	4B	do	640	320	13	320
	5	April 1950	640	640	5	640
FM1	1A	August 1948	640	640	25	320
	1B	do	640	640	25	320
	3B	July 1949	320	160	13	320
	4B	August 1949	320	320	12	320
	5B	do	320	320	12	320
	6B	do	320	320	12	640
	9	April 1950	1,280	640	5	640
Lee	1A	August 1948	640	640	25	640
	1B	do	640	640	25	640
	4A	July 1949	640	320	14	640
	4B	do	640	320	14	640
	5A	August 1949	640	320	13	640
	6A	September 1949	640	640	11	1,280
	7	April 1950	640	640	5	1,280

[1] Tested within 1 week following desiccation.
[2] Numbers are reciprocals of hemagglutinin titers.

antigen was not appreciably reduced in titer on desiccation, nor was the potency of the dried materials significantly reduced on prolonged storage at refrigerator temperature.

Residual Moisture and Stability of Lyophilized Antigens on Heating

The data presented in table 2 revealed that the residual moisture values of the dried antigens ranged from 0.21 percent to 1.68 percent. All lots (PR8: 5, 11B, 11S, 12B, and 12; FM1: 9; and Lee: 7) with moisture values of 0.80 percent or less were dried in the Bauer and Pickels, or Stokes type equipment, by the procedures described earlier in this report; PR8: 4B, FM1:6A, and Lee: 6B were not. With the latter materials (which were dried on the Bauer and Pickels machine), the temperature of the refrigerated compartments of the drying apparatus was slowly elevated to room temperature over a period of 12 to 14 hours after beginning the procedure; this resulted in less thorough dehydration of the antigens which had residual moisture contents of 0.88 to 1.68 percent.

Table 2. *Stability of desiccated influenza hemagglutinating antigens on heating*

Strain	Lot No.	Drying		Moisture content [1] (percent)	Control titer [2]	Titer after treatment				
		Apparatus	Closure			Vial	37° C. 2 wks.	37° C. 7 wks.	56° C. 4 days	60° C. 2 days
PR8	5	B & P [3]	Glass seal	0.21	640	1	640	640	640	320
						2	320	ND	1,280	ND
	11B	B & P	do	.32	640	1	[4] ND	ND	640	320
						2	ND	ND	640	320
	11S	Stokes [5]	Rubber	.61	640	1	ND	ND	640	320
						2	ND	ND	640	320
	12B	B & P	Glass seal	.68	640	1	ND	ND	640	320
						2	ND	ND	640	320
	12S	Stokes	Rubber	.80	640	1	ND	ND	640	320
						2	ND	ND	640	320
	4B	B & P	Glass seal	1.68	640	1	320	ND	0	0
						2	640	ND	0	0
FM1	9	B & P	do	.32	640	1	320	640	1,280	640
						2	640	ND	640	640
	6A	B & P	do	.88	320	1	320	ND	0	0
						2	320	ND	0	0
Lee	7	B & P	do	.58	640	1	320	640	160	0
						2	640	ND	160	0
	6B	B & P	do	1.62	1,280	1	640	ND	0	0
						2	640	ND	0	0

[1] Average value of 2 to 4 ampules tested.
[2] Samples held at 4° C.
[3] B & P=Bauer and Pickels apparatus (*5*).
[4] ND=Not done.
[5] Stokes=Stokes apparatus (*7*).

The stability of the dried antigens on heating was related to the moisture value. With the exception of Lee lot 7, all antigens with values of 0.80 percent or less were stable at all the storage temperatures tested, while those with residual moistures of 0.88 percent or greater were completely inactivated on heating at 56° C. or 60° C. Lee lot 7, in which the moisture figure was only 0.58 percent, was partially inactivated at 56° C. and completely at 60° C. All the antigens tested, irrespective of moisture content, were stable for at least 2 weeks at 37° C.

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The adaptation of the chamber freeze-drying method to the production of stable influenza antigens represents some advance over the manifold drying technique heretofore employed in that it permits the use of bottle-type containers which can be sealed with rubber closures. While the over-all labor consumption in the filling, loading, and sealing of glass-seal ampules is roughly equal to that involved in processing the rubber closure bottles, the cost of container material in the latter instance represents only a small fraction of the former. In addition, the rehydration of antigen in the rubber sealed bottle is simple, and reconstituted material can be stored in the same vessel.

Stability of Rehydrated Antigens

The hemagglutinin in the rehydrated preparations of antigen was relatively stable (table 3), but, in order to obtain consistent titration endpoints with materials which were stored at 4° C. after rehydration, certain precautions were necessary. Precipitates appeared within a few days in the rehydrated antigens and increased progressively over a period of weeks. This phenomenon was more striking in reconstituted antigens than in the virus preparations which were maintained in the fluid state from the time of harvest. Reproducible results were obtained with such stored solutions only when the virus was eluted from the precipitated material. This was accomplished by dispersing the flocculated material uniformly in the solution, then removing a sufficient amount for the day's work, diluting 1:20 with physiological saline solution, and allowing the diluted material to stand at room temperature for 2 hours. When prepared in this manner, the resultant solutions contained as much hemagglutinin after storage of the stock antigen for 7 weeks at 4° C. as they did when initially rehydrated;

Table 3. *Stability of desiccated influenza A and B hemagglutinating antigens following rehydration*

Strain	Lot No.	Titer of rehydrated material stored at					
		4° C.				−20° C.	
		0 days	9 days	23 days	52 days	16 days	52 days
	1A	160	320	160	160		
	3A	320				320	320
PRS	3B	640	1,280	640	640		
	4B	320				160	320
	5	640	640	320	320		
	1B	320	320	160	160		
	3B	320				320	160
FM1	4B	320	160	160	160		
	6B	640				320	320
	9	640	320	320	320		
	1A	640	640	640	640		
	4A	640				640	640
Lee	5A	640	1,280	640	640		
	6A	1,280				320	640
	7	1,280	1,280	640	640		

moreover, the specificity of the hemagglutinin was maintained. Rehydrated antigens which were refrozen and stored at −20° C. did not develop the precipitates mentioned above and their hemagglutinin content remained undiminished for 2 months.

Stability of Lyophilized Rooster Antiserum

Tests performed on 13 pools of lyophilized rooster antisera revealed no loss in titer of materials following drying and storage at 4° C. for periods up to 2 years.

Summary and Conclusions

A method for preparing dried antigens and control antisera for the agglutination-inhibition test for viral influenza has been described. Both manifold- and chamber-type drying equipment are satisfactory for this purpose. The hemagglutinating antigens show no more than twofold reduction in titer on desiccation. Properly dried antigens are stable for at least 25 months when stored at 4° C. and for at least 51 days at 37° C. Antigens with moisture values as high as 0.80 percent can usually be heated at 56° C. for 4 days or at 60° C. for 2 days without significant loss in titer while preparations with 0.88 percent or greater moisture content are completely inactivated under these conditions. Dried rooster control antisera are stable for at least 2 years when stored at 4° C.

REFERENCES

(*1*) van Rooyen, C. E., and Rhodes, A. J.: Virus Diseases of Man. Thomas Nelson and Sons, New York, 1948, p. 640.

(*2*) Committee on Standard Serological Procedures in Influenza Studies: An agglutination-inhibition test proposed as a standard of reference in influenza diagnostic studies. J. Immunol. **65**: 347–353 (1950).

(*3*) American Type Culture Collection. Viral and Rickettsial Registry. Washington, D. C., 1950, pp. 3, 4.

(*4*) National Institutes of Health: Culture media for the sterility test. Circular, 2d revision, dated February 5, 1946.

(*5*) Bauer, J. H., and Pickels, E. G.: Apparatus for freezing and drying virus in large quantities under uniform conditions. J. Exper. Med. **71**: 81–88 (1940).

(*6*) Smadel, J. E., Randall, R., and Warren, J.: Preparation of Japanese encephalitis vaccine. Bull. U. S. Army Med. Dept. **7**: 963–972 (1947).

(*7*) Flosdorf, E. W.: Freeze-drying (Drying by Sublimation). Reinhold Publishing Corp., New York, 1949, Chapter 5.

A Yolk Sac Technique for the Routine Isolation of *Brucella*

Injection of Clotted Blood Specimens Into Embryonating Eggs With Recovery of All Three Species

By KATHLEEN GAY, B. S., and S. R. DAMON, Ph. D.*

Efforts to recover *Brucella* from blood specimens submitted to a public health laboratory are often unsuccessful. Because of the apparent need of a more successful method adaptable to routine use, investigation of the embryonating egg as a possibly superior medium for the recovery of *Brucella* was undertaken. Various investigators, e. g., Goodpasture and Anderson (*1*), Buddingh and Womack (*2*), and Ruiz-Castaneda (*3*), had previously described this organism as preferentially an intracellular parasite; and Spink et al. (*4*), among others, had found the embryonating egg valuable in the study of therapeutic agents for the treatment of brucellosis. However, to our knowledge, no one had attempted to employ the egg on a large scale in the isolation of *Brucella*.

A preliminary experiment (*5*) indicated that the yolk sacs of 3- to 6-day-old embryos provided a highly nutritive medium for multiplication of *Brucella*, even though only a few organisms were present, and that this age range was probably optimum for the inoculation of blood.

This paper presents the investigation of a yolk sac technique and the results of its application. Embryos 3 to 5 days old were employed for the inoculation of clotted blood specimens. All three species of *Brucella* were recovered.

Materials and Methods

Specimens

Clots from specimens of blood received routinely at the Indiana State Board of Health for diagnostic agglutination tests were employed. Following completion of the serological test, one-half of the clot was forced through a 5 ml. syringe, without the needle, into a tube of crystal violet tryptose broth for routine culture. The other half was then prepared for animal and egg inoculations by expelling

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it into a bottle containing glass beads and 5–7 ml. of tryptose broth. The bottles were stoppered and shaken 3 minutes for further disintegration of the clots.

Eggs

White Leghorn "hatching quality" eggs (av. wt. 59 gm.) were obtained weekly from a local poultry supply house and held at 20° C. until the day of incubation. That is, a week's supply was received on Wednesday and a sufficient number incubated each Monday and Friday, so that each day of the week 3-, 4-, or 5-day old live embryos were available. Before and after injection, all eggs were kept at 98°–99° F. (±37° C.), relative humidity 50°–56°, in an electric hatchery incubator. They were not turned at any time, since doing so was found nonessential to the technique and complicated the procedure for locating the yolk sacs.

Inoculation of Eggs

Eggs which had incubated 3 to 5 days were candled, using a 100-watt bulb installed in a plywood box 20″ square. The interior of the box was painted black and one side left entirely open to receive the egg racks. The opening was covered with a photographer's heavy black cloth. With this device it was possible to candle accurately embryos as young as 3 days, mark the position of the embryos, and select the live ones for inoculation.

A small hole was drilled into the large end of the egg with an electric table model dental drill and No. 22 S. S. White abrasive point. With a 20-gage, 1½-inch hypodermic needle, 0.5 ml. of the blood-broth specimen was injected into the yolk sac. In making the inoculation the egg, with the marked embryo at the top, was placed horizontally on the table and the needle inserted toward the center for 0.5–0.75 inch. If the embryo was 3 days old, the direction of the needle was slightly upward; if 4- or 5-days, directly inward toward the center. The area around each hole was swabbed before and after inoculation with tincture of iodine, and the hole finally sealed with a swab of collodion.

Examination of Eggs

Examinations consisted of two or three subcultures from the yolk at about 4- or 5-day intervals and in some instances a final harvesting of all live embryos on the 18th or 19th day of total incubation, the embryo ages at the three subculture periods being 9–10, 14, and 18–19 days, respectively.

The yolk was withdrawn in a manner similar to that of the injections. However, since the position of the yolk sac gradually changes with further development of the embryo, allowances must be made

for this by inserting the hypodermic needle at different angles and depths. As a rule, the older the embryo the more the yolk position shifts from a high anterior position to a low posterior one. The chart explains diagrammatically the method for withdrawing yolk from the different age embryos.

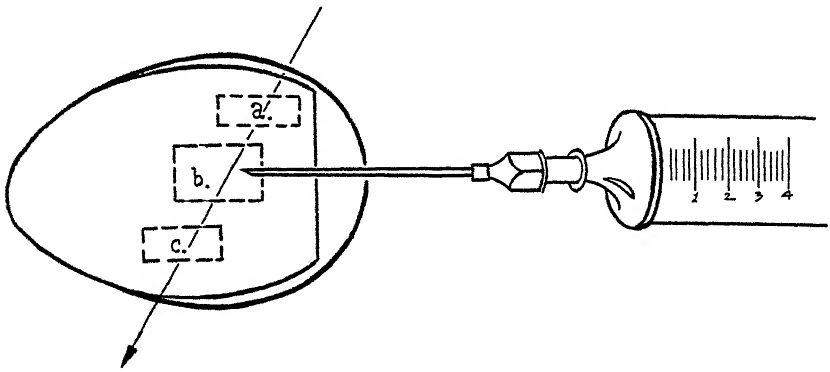

Diagram of the relative positions of the yolk sac as the embryo develops. Each rectangle represents the approximate center of the yolk sac at (a) 3 days, (b) 4–5, 9–10 days, and (c) 14 days of age.

Several drops of yolk material withdrawn from each egg were streaked over the surface of a slightly dehydrated tryptose agar (pH 6.6–6.7) plate. Those embryos remaining viable on the 18th or 19th day of incubation were harvested and portions of the blood, yolk sac wall, internal organs, and embryo fluids streaked onto tryptose agar plates. All plates, before being discarded as negative, were held 2 weeks in an incubator equipped to maintain a CO_2 concentration of approximately 10 percent.

C-V Enrichment Technique

The broth employed was crystal violet tryptose broth (modification of a Huddleson formula) routinely used in this laboratory for the isolation of *Brucella*. The final dye concentration was 1:1,000,000. Following inoculation of the clot, the tubes of broth were placed in the CO_2 incubator; and at the end of each week, for a period of 3 weeks, the broth was subcultured to a plain tryptose agar plate and a tryptose agar plate with crystal violet added to a final concentration of 1:1,000,000. Plates were incubated as described above.

Guinea Pig Inoculation

The clot was treated for guinea pig inoculation in the same manner as for egg injections, except that each guinea pig received 1–1.5 ml. per pig subcutaneously in the groin region whereas each egg received

only 0.5 ml. Two pigs per specimen were inoculated. They were sacrificed at the end of one month and the internal organs cultured. An agglutination test was also performed on each pig.

Identification of Brucella

Suspicious colonies on plates were fished to tryptose agar slants and incubated in the CO_2 incubator for 24–48 hours. A spot agglutination test was then made from the growth on the slant, using *Br. abortus* antiserum. If clumping occurred, duplicate tryptose agar slants were inoculated, one incubated in air and one in CO_2 to check growth requirements. A saturated lead acetate paper was placed in the mouth of the latter to determine H_2S production. Growth from the original slant was also streaked onto basic fuchsin and thionin dye plates (dye concentration 1:100,000) for species typing. The remaining growth was then suspended in 0.5 percent formalinized saline, diluted to the proper density, and tube agglutination tests set up with both the *Br. abortus* antiserum and the homologous serum from the patient.

Experimental Results

The first specimens of blood injected into eggs were clots from the heart blood of autopsied guinea pigs, which had been inoculated subcutaneously with human blood from suspected cases of brucellosis, and clotted peripheral blood from swine experimentally infected with *Brucella suis*. Fifteen specimens were injected into 3- and 5-day-old embryonating eggs and two yolk subcultures made. Four *Br. suis* strains were recovered, one from the guinea pig and three from the swine bloods. About the same time a *Br. melitensis* type was isolated from the blood of a treated ambulatory case when the clot was inoculated into the yolk sacs of 3-day-old embryos. This latter isolation was not made from either the crystal violet tryptose broth or the guinea pigs, although the clot was examined by both these methods. Following the success with these preliminary specimens, it was decided to continue the investigation, employing clots from specimens received routinely for diagnostic agglutination tests.

Experiment 1. Twenty-seven human clots from sera with varying agglutination titers were inoculated into each of six eggs and into a tube of C-V tryptose broth, as described under Materials and Methods. Fifteen of the clots were further examined by injection into guinea pigs. Seventeen sets of the eggs receiving the blood clot specimen also received penicillin G in three of the six eggs in an attempt to control the overgrowth of contaminants. Examinations consisted of two weekly yolk subcultures.

Three of the clots inoculated proved heavily contaminated when

injected into the embryos, even though penicillin was used, and the eggs were not examined. The 24 satisfactory examinations yielded two *Br. abortus* strains. No recoveries were made from either the C-V broth or the guinea pigs, although both mediums received a portion of the clots which yielded these two isolations.

Experiment 2. The specimens in this group were of the same nature as those employed in experiment 1. However, the clot-broth mixture was inoculated into four eggs each and penicillin was not used. Fourteen clots were injected into eggs and C-V tryptose broth, with eight of these also being examined by the guinea pig inoculation technique.

One *Br. abortus* strain was recovered from the chick embryo yolk but not from the C-V tryptose broth nor the inoculated guinea pigs. No additional recoveries were made by either of the last two methods. One blood clot, because of contamination, was considered unsatisfactory for egg inoculation.

Experiment 3. The specimens comprising this group came from patients whose sera exhibited a complete agglutination at a 1:20 or higher serum dilution level when the test was made with a rapid slide antigen. Materials and techniques used throughout this experiment were described in the foregoing section. A total of 81 specimens were injected into the embryo yolk sacs. All the clots were simultaneously examined by inoculation into C-V broth; and 71 of them, by injection into guinea pigs. Those eggs inoculated with 41 of the specimens were examined a third time, as previously described.

When injected into eggs, 23 clots resulted in a heavy contamination which rapidly killed all embryos and were considered unsatisfactory for egg examinations. From the remaining 58 satisfactory sets of eggs, nine recoveries, six *abortus* and three *suis* strains, were made. None of these were recovered from the guinea pigs, although all except one of the specimens yielding an isolation were injected into the pigs; and only five of them were obtained from the incubated C-V broth.

From the entire group of specimens included in this experiment two additional isolations were made: an *abortus* strain from the C-V broth only, this particular specimen being unsatisfactory for egg examination; and a *suis* strain recovered from both the guinea pig and the C-V broth, with the chick embryos failing to yield the isolation. In those instances in which the yolks were examined for a third time or the embryos harvested, no additional recoveries were made.

Summary of Experiments. To summarize, a total of 138 blood clot specimens, of which 123 were from human sources, were inoculated into the embryonating egg. Four *suis* strains were recovered from the 15 lower animal clots included in the study.

The 123 human clots were further examined by enrichment in C-V

broth and 95 of them by guinea pig inoculation. Twenty-seven clots, upon injection into the eggs, resulted in a heavy contamination and rapid death of the embryos. Thus, only 96 specimens were considered satisfactory for egg inoculations, and from this number 14 recoveries—1 *melitensis*, 4 *suis*, and 9 *abortus*—were made, with the egg technique yielding all but one *suis* strain. From these same 96 specimens the guinea pigs yielded one *Brucella* strain and the C-V broth, six. Data concerning these clots are presented in table 1. Eleven isolations came from patients exhibiting acute symptoms at the time of collecting the specimens, while the other three were from asymptomatic cases. No recoveries were made from patients with chronic complaints. Also, all the isolations came from persons with agglutination titers of at least a 1:80 serum dilution.

Table 2 summarizes the total recoveries made from blood clots (inclusive of the guinea pig and swine bloods) inoculated into the

Table 1. *Data relative to specimens examined by the egg inoculation technique*

Symptomatology of patients at time of collecting specimens

	Acute	Chronic	Asymptomatic		No information
			Treated	Untreated	
Number	41	28	17	4	6
Isolations	11	0	1	2	0

Agglutination titer [1] of sera from specimens

	1:20	1:20-1:80	1:80-1:320	1:320-1:640	1:640
Number	5	8	48	21	14
Isolations	0	0	7	5	2

[1] The highest serum dilution in which a 2+ agglutination reading was obtained.

Table 2. *The recovery of* Brucella *from blood clots examined by the yolk sac technique*

Type	Laboratory No.	Titer [1]	Specimen source	Age of embryo: days	
				At injection	At isolation
Suis	2		Swine	5	13
	12		do	5	13
	19		do	5	10
	5973		Guinea pig	3	8
	4612	1:80	Human	5	14
	4621	1:80	do	3	8
	4626	1:640	do	3	13
Melitensis	6356	1:320	do	3	12
Abortus	3338	1:320	do	4	9
	3953	1:160	do	4	10
	4046	1:80	do	3	10
	4138	1:320	do	4	9
	2172	1:160	do	4	9
	4712	1:320	do	5	10
	4776	1:320	do	3	10
	1403	1:160	do	3	8
	1575	1:160	do	3	8

[1] The highest serum dilution in which a 2+ agglutination reading was obtained.

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yolk sacs of 3- to 5-day embryonating eggs. The age of the embryo at the time of injection of the clot and also at the time of recovery of the strain is included. The age given for the time of isolation is that age of the first embryo to yield an isolation on the day the yolk was withdrawn. Primary isolations have been made from all three ages employed, although not all eggs inoculated from any one specimen always yielded a simultaneous isolation. Nearly all recoveries were obtained by the eighth day of incubation of the injected specimens; and no doubt the others would have been if the yolk withdrawal had occurred at that time.

Discussion

It is not the intention of the authors to suggest that the specimens employed in this study are the most suitable for the recovery of *Brucella* from suspected cases of brucellosis. However, they are the type most frequently submitted by a physician who desires a laboratory diagnosis, usually a determination of the agglutination titer; and certainly a test which permits isolation of the causative organism from the same specimen used in performing an agglutination test would be highly desirable.

Also, it should be mentioned that the percentage of isolations from these specimens has been decidedly influenced by two limiting factors. First, the amount injected into each egg was actually the equivalent of only one-fourth of 0.5–1.5 ml. of whole blood. This amount is extremely small when compared with the amount of blood considered desirable for culturing procedures. Second, although the specimens usually came from a patient showing a fairly high agglutination titer, as shown in table 1, we find that less than 50 percent came from persons exhibiting acute symptoms. Many clots from treated cases and from persons with chronic complaints were included in the series. Taking into consideration these factors, the egg embryo yolk sac technique appears to be an efficient as well as a comparatively rapid means of isolating *Brucella* from clotted blood specimens.

Summary

1. A method for using the embryonating chick egg for primary isolation of *Brucella* from the blood stream has been presented and supporting experimental data given.

2. Essentially, this technique consists of injecting specimens directly into the yolk sacs of 3-, 4-, and 5-day-old embryos and subculturing the yolk periodically.

3. Seventeen recoveries, representing all three species of *Brucella* have been made from clotted blood specimens injected into the embryo yolk sacs.

4. The egg embryo yolk sac technique is recommended because: (*a*) it provides living tissue cells in a compact medium; (*b*) it permits recovery of all three types of *Brucella*: (*c*) it gives comparatively quick results; and (*d*) it entails a minimum amount of danger for laboratory personnel.

ACKNOWLEDGMENT

The authors are indebted to the Department of Veterinary Science, Agricultural Experiment Station, Purdue University, for the guinea pig and swine clotted blood specimens employed in the initiation of this study; and for the provision, maintenance, and examination of all guinea pigs to which reference has been made. The data resulting from the examinations is extracted from another phase of the joint brucellosis project and is included in this paper only inasmuch as it pertains to specimens inoculated into embryonating eggs.

Since submission of the manuscript for publication the authors have received a communication from Dr. Felix E. Ramacciotti of the Faculty of Medicine, Cordoba University, Cordoba, Argentina, describing the successful use of the chick embryo in recovering *Brucella* from the blood stream of 10 patients. De la Revista de la Facultad de C. Médicas de Córdoba, vol. 9, No. 1, 1951.

REFERENCES

(*1*) Goodpasture, E. W., and Anderson, K.: The problem of infection as presented by bacterial invasion of the chorio-allantoic membrane in chick embryos. Am. J. Path. **13:** 149 (1937).

(*2*) Buddingh, G. J., and Womack, F. C.: Observations on the infection of chick embryos with *Bacterium tularense, Brucella,* and *Pasteurella pestis.* J. Exper. Med. **74:** 213 (1941).

(*3*) Ruiz-Castaneda, M.: Studies on the pathogenesis of brucellosis. Proc. Soc. Exper. Biol. and Med. **64:** 298 (1947).

(*4*) Spink, W. W., Hall, W. H., Shaffer, J. M., and Braude, A. I.: Human brucellosis. J. A. M. A. **136:** 382 (1948).

(*5*) Gay, Kathleen, and Damon, S. R.: Use of the chick embryo for isolation of *Brucella.* Multiplication of the organism in the yolk sac and selection of the embryo age optimal for isolation from blood. Pub. Health Rep. **65:** 1187 (1950).

A Modification of the Winter and Sandholzer Media and Technique for Enterococci Detection

By Wen-Lan Lou Wang, M.S., and Stuart G. Dunlop, Ph.D.*

The use of fecal streptococci as an indicator of pollution of water has been proposed by a number of investigators (*1–5*). Also, various media and techniques have been suggested for the detection of these organisms (*4, 6–11*). In the course of experiments conducted on a Public Health Service research project in this laboratory, poor confirmation of presumptive positive counts from sewage and irrigation water was obtained, when the media proposed by Winter and Sandholzer (*10*) were used for the estimation of enterococci. The present investigation was undertaken to determine the factor or factors causing the poor confirmation and, if possible, to suggest methods of overcoming the difficulties encountered.

Materials and Methods

The method described by Winter and Sandholzer consisted of two parts. The production of acid and growth turbidity in a sodium azide enrichment medium after incubation at 45° C. was interpreted as presumptive evidence of the presence of enterococci. Positive presumptive tubes were then confirmed by inoculating a slant-broth preparation of a penicillin-sodium azide medium. Pin-point colonies on the slant, growth sediment in the broth, the presence of gram-positive ovoid streptococci in the broth, and a negative catalase test constituted a confirmed positive.

In the preliminary experiments in this study, the technique and media proposed by Winter and Sandholzer were employed, except that the positive presumptive tubes were not transferred to the confirmation medium until after 18 to 20 hours' incubation. Winter and Sandholzer recommended that the transfers be made as soon after 8 hours as the tubes became positive. Duplicate tubes of the presumptive medium were inoculated with sewage-polluted irrigation water collected locally, using at least three dilutions for each sample; and counts were computed in terms of the most probable number

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(MPN), as specified for the coliform group of organisms in Standard Methods for the Examination of Water and Sewage (*12*). The pH of each positive presumptive tube was determined with a Beckman pH meter at the time of transfer. In addition to the Winter and Sandholzer confirmation technique, a loopful of each presumptive positive growth was streaked on a blood agar plate, and the organisms isolated were tested for their ability to grow in 6.5-percent sodium chloride broth and on 40-percent bile agar, and by the reduction of litmus milk and 0.1-percent methylene blue milk. This procedure was likewise carried out with the confirmed growths.

It was noted in the early experiments that better confirmation results were obtained if one drop of the sediment of the positive presumptive growth was transferred to the confirmation medium rather than only one loopful of the culture, as suggested by Winter and Sandholzer. Also, when 10 ml. quantities of sample were required, 10 ml. of double strength presumptive medium were employed rather than 2 ml. of fivefold strength medium, since the latter frequently showed a positive pH change simply on addition of the sample.

After studies were made of the effect of the 18- to 20-hour incubation time, as compared with 10 to 24 hours, modifications of the original presumptive medium of Winter and Sandholzer were tried in an effort to retard the speed of the pH change to permit use of overnight incubation. Experiments were conducted to compare these modifications with the original medium of Winter and Sandholzer (WS) and the *Streptococcus fecalis* (SF) medium of Hajna and Perry (*7*). Of the various modifications tried, the following formula gave the most satisfactory results:

	Percent
Tryptone (Difco)	0.7
Tryptose (Difco)	.3
K_2HPO_4	.4
Glucose	.5
Yeast extract (Difco)	.5
Sodium azide	.04
Brom thymol blue	.0032

Experimental Studies and Discussions

Preliminary experiments indicated that both the time and temperature of incubation of the presumptive positives might affect the results of confirmation. Table 1 shows that poor confirmation resulted when the presumptive positives (growing in original WS presumptive medium) were allowed to incubate overnight (20 hours); better confirmation resulted if the presumptive positives were transferred to the confirmation medium as soon as the tubes became positive. In exper-

Table 1. *The effect of incubation time on the confirmation of positive presumptive tubes*

Experiment No.	Presumptive test [1]			Confirmation tests [2]			
	Incubation at 45° C. (hours)	MPN count per 100 ml.	pH range positives	Incubation at 37° C. (hours)	MPN count per 100 ml. WS medium	Blood plates	WS medium
Va	20	2,300	4.99–6.57	24	230	[3] 4/6	[3] 2/6
Vb	10–24	2,300	5.11–6.57	24	2,300	6/6	6/6
VIa	20	6,200	4.30–6.04	24	62	6/7	3/7
VIb	10–24	6,200	4.96–6.04	24	1,300	6/7	5/7

[1] Original WS presumptive medium.
[2] Confirmation by blood plates included growth in 6.5-percent NaCl broth and on 40-percent bile agar, and reduction of litmus milk and 0.1-percent methylene blue milk. Confirmation by WS medium included pin-point colonies on the slant, growth sediment in the broth, the presence of gram-positive ovoid streptococci in the broth, and a negative catalase test.
[3] Ratio of confirmed positives to presumptive positives.

iment Vb, four more positive tubes were confirmed in the WS confirmation medium than in Va, and experiment VIb showed two more positive confirmed tubes than VIa. These differences were reflected likewise in the relative MPN counts. Also, definite differences in the quantity of growth could be seen on the blood plates inoculated from these presumptive tubes; much heavier growth resulted when the positives were transferred early. It is apparent, too, in this table, that there was less pH change in the cultures transferred soon after they became positive. Combination of the results of these two experiments shows that only 5 tubes out of 13, or 38 percent, were confirmed using the 20-hour incubation time; while 11 out of 13, or 85 percent, were confirmed when the presumptive positives were transferred to the confirmation medium as soon as the tubes became positive. This difference is statistically significant at the 5-percent level. Thus, it may be concluded that the delayed transfer of the growth from presumptive positives to the confirmation medium results in poor confirmation.

It has been demonstrated by Bagger (*13*) that enterococci have relatively high resistance to acidity and heat. Sherman (*14*), however, stated that *Streptococcus zymogenes* and *Streptococcus durans* had lower heat resistance than the other fecal streptococci. So it may be possible that the poor confirmation with the WS medium resulted from death or attenuation of the enterococci by the combination of high acidity and long incubation time at the 45° C. temperature.

Attempts were then made to protect the enterococci in the positive presumptive tubes by retarding the speed of the pH change. Table 2 shows the effect of modifying the WS presumptive medium with a slight increase in the protein content and by the addition of buffer in the form of K_2HPO_4. Included also is a comparison of these media with the SF medium of Hajna and Perry. This table indicates the modified WS medium gave slightly better confirmation than the

Table 2. *Effect of buffering WS presumptive medium and comparison with SF medium*

[Incubation of presumptives: 45° C. for 18 hours; incubation of confirmation tubes: 37° C. for 24 hours]

Experiment No.	Presumptive test			Confirmation tests [1]		
	Medium used	MPN count per 100 ml.	pH range positives	MPN count per 100 ml WS medium	Blood plates	WS medium
VIII	WS	2,300	4 89–5 24	62	[2] 6/6	[2] 3/6
	WS+buffer and protein	2,300	6 02–6 24	2,300	6/6	6/6
IX	WS	620	4.77–5.26	230	3/3	2/3
	WS+buffer and protein	130	5.81–6.69	130	2/2	2/2
	SF	60	5.68	60	1/1	1/1
X	WS	2,300	5.02–6.08	620	6/6	5/6
	WS+buffer and protein	620	5.22–5 91	620	5/5	5/5
	SF	230	5.51–6.15	230	4/4	4/4

[1] Confirmation by blood plates included growth in 6.5-percent NaCl broth and on 40-percent bile agar, and reduction of litmus milk and 0.1-percent methylene blue milk. Confirmation by WS medium included pin-point colonies on the slant, growth sediment in the broth, the presence of gram positive ovoid streptococci in the broth, and a negative catalase test.

[2] Ratio of confirmed positives to presumptive positives.

original WS presumptive medium, and the pH changes were less. However, in general, lower presumptive MPN counts were obtained, that is, fewer tubes showed positive. Although in these experiments 10 tubes out of 15, or 67 percent, were confirmed from the WS presumptive medium compared with 13 out of 13, or 100 percent, from the modified WS medium, statistical evaluation of this difference indicates borderline significance (critical ratio=1.80; P=7.2 percent).

The SF medium is not significantly better than the original WS medium due, probably, to the small number of tubes involved in the calculations with the SF medium. SF medium contains greater amounts of sodium azide, protein, and phosphate buffer than either WS or modified WS medium, and is undoubtedly more inhibitory. Further, it was noted that occasionally tubes of the SF medium which did not show a change in the indicator could be demonstrated to contain enterococci. This would suggest that the pH range of brom cresol purple, 5.2 to 6.8, as used in SF medium, is too low to indicate light growth of the organisms. Brom thymol blue which was used in the WS and modified WS media has a pH range of 6.0 to 7.6. Mallmann and Seligmann (*11*) also noted that streptococci frequently were present in the tubes of SF broth when no visible color change of the indicator took place.

In the experiments thus far reported, the maximum incubation time of the presumptive media had been 20 hours. It was thought that continued observation of the negative tubes for an additional 28 hours might result in better presumptive counts. That this is so is shown in table 3. By prolonging the incubation time of the negative tubes, the modified WS medium and the SF medium showed presumptive MPN counts more comparable with those of the original WS medium, while still maintaining good confirmation. Combina-

Table 3. *Effect of prolonging incubation time of negative presumptive tubes*

[Incubation of presumptives: 45° C. for 18–48 hours; incubation of confirmation tubes: 37° C. for 24 hours]

Experiment No.	Presumptive test			Confirmation tests [1]		
	Medium used	MPN count per 100 ml.	pH range positives	MPN count per 100 ml. WS medium	Blood plates	WS medium
XI	WS	62,000	4.81–6.58	500	[2] 9/9	[2] 5/9
	WS+buffer and protein	23,000	5.47–6.37	23,000	8/8	8/8
	SF	620	5.28–6.29	620	5/5	5/5
XII	WS	62,000	4.95–5.88	5,000	8/9	6/9
	WS+buffer and protein	62,000	5.40–6.89	62,000	9/9	9/9
	SF	6,200	5.23–6.33	6,200	7/7	7/7
XIII	WS	23,000	4.92–6.98	6,200	7/8	6/8
	WS+buffer and protein	23,000	5.32–7.03	6,200	7/8	7/8
	SF	23,000	5.20–6.31	6,200	8/8	7/8

[1] Confirmation by blood plates included growth in 6.5-percent NaCl broth and on 40-percent bile agar, and reduction of litmus milk and 0.1-percent methylene blue milk. Confirmation by WS medium included pin-point colonies on the slant, growth sediment in the broth, the presence of gram-positive ovoid streptococci in the broth, and a negative catalase test.

[2] Ratio of confirmed positives to presumptive positives.

tion of the results of experiments XI, XII, and XIII revealed that enterococci were isolated on blood plates from nearly all the positive WS presumptive tubes (24 out of 26), but only 17 of the 26, or 65 percent, were confirmed in the WS confirmation medium. Twenty-four of the 25 positives, 96 percent, from the modified WS medium, and 19 of the 20 positives from the SF medium, 95 percent, were confirmed in the WS confirmation medium. The differences, comparing the confirmation results (in WS confirmation medium) from the modified WS medium and the SF medium with the results from the original WS presumptive medium, are statistically significant at the 5-percent level. Thus, by buffering the WS presumptive medium to retard the pH change of the positives, and by observing the negatives for an additional 28 hours, good confirmation and more comparable presumptive counts were obtained. The SF medium, however, still did not give as high counts as the WS or modified WS media.

In all the experiments the organisms isolated on blood plates from the confirmation tubes proved to be enterococci. On the other hand, gram-positive rods, diphtheroids, atypical enterococci (organisms failing to give characteristic reactions in all four tests used) and streptococci other than enterococci were isolated occasionally from the presumptive tubes. Mallmann and Seligmann (*11*) likewise found that gram-positive rods occasionally occurred in azide dextrose broth (Difco), azide broth (Mallmann *6*), and SF broth of Hajna and Perry (*7*) when these media were used to test the presence of streptococci in river water contaminated by sewage and in swimming pool water. The occurrence of atypical enterococci in swimming pool water was noted by Ritter and Treece (*5*).

Table 4 shows the combined confirmation results of experiments

Table 4. *Comparison of confirmation on blood plates and in WS confirmation medium*

[Combined results of experiments VIII through XIII]

Presumptive medium	Total positive presumptive tubes	Confirmation [1]			
		Blood plates		WS medium	
		Tubes positive	Percent	Tubes positive	Percent
WS	41	39	95	27	66
Modified WS	38	37	97	37	97
SF	25	25	100	24	96

[1] Confirmation by blood plates included growth in 6.5-percent NaCl broth and on 40-percent bile agar, and reduction of litmus milk and 0.1-percent methylene blue milk. Confirmation by WS medium included pin-point colonies on the slant, growth sediment in the broth, the presence of gram-positive ovoid streptococci in the broth, and a negative catalase test.

VIII through XIII. Comparison of the confirmation on blood plates indicates that there is little difference among the three media as to the validity of the observed presumptive positives, although it appears from this and the other tables that the SF medium gives lower counts than the other two media. A striking difference, however, is noted in the proportion of tubes confirmed in the WS confirmation medium, only 66 percent of the WS presumptive positives being confirmed, compared with 97 and 96 percent from the modified WS and SF media, respectively.

In the experiments already described, many organisms not capable of growing in the confirmation medium were isolated from positive WS presumptive tubes and later were identified as enterococci. On subsequent inoculation of six of these cultures into confirmation media, all showed positive confirmation. Thus, it might be suggested that the confirmation medium of Winter and Sandholzer required a rather heavy inoculum of healthy organisms. It was also noted that some of the confirmation tubes, negative after 24 hours, showed growth after 5 days of incubation, and enterococci were isolated. This might be explained by the probable inactivation of penicillin after several days' incubation at 37° C. Ostrolenk, Kramer, and Cleverdon (*4*) reported that the addition of 6.5-percent NaCl to SF medium reduced the most probable number counts of enterococci. White and Sherman (*9*) also showed that *Streptococcus durans* in milk was inhibited partially in the presence of 325 Oxford units of penicillin per liter. Accordingly, attempts were made to modify the confirmation medium by reducing the quantities of penicillin or NaCl. The results were suggestive of the fact that such modification would increase the proportion of confirmation. Apparently, good confirmation can be obtained by reducing the quantity of the broth containing the penicillin and NaCl and inoculating heavily with sediment from the presumptive positives.[1] However, if the Winter and Sandholzer presumptive

[1] Method used by the Environmental Health Center, Public Health Service, Cincinnati, Ohio.

medium is modified by the addition of buffer and by increasing the protein, good confirmation results can be obtained with the unmodified confirmation medium. Further work is in progress on the use of these and other media for the estimation of enterococci in vegetable washings.

Summary

Poor confirmation of presumptive positive counts of fecal streptococci from sewage and irrigation water had been obtained using the media proposed by Winter and Sandholzer. Studies on blood agar plates, followed by biochemical tests on the organisms isolated, indicated that enterococci were present in at least 95 percent of the presumptive positives tubes, even though only 66 percent would confirm in the Winter and Sandholzer confirmation medium. By buffering the Winter and Sandholzer presumptive medium to retard the pH change of the positives and by observing the negatives for an additional 28 hours, good confirmation and comparable presumptive counts were obtained.

REFERENCES

(*1*) Savage, W. C., and Read, W. T.: The significance of streptococci in water supplies. J. Hyg. **15:** 334–351 (1916).

(*2*) Mallmann, W. L.: Streptococcus as an indicator of swimming pool pollution. Am. J. Pub. Health **18:** 771–776 (1928).

(*3*) Thresh, John: The Examination of Water and Water Supplies, ed. 5. Edited by E. V. Suckling, Blakiston Co., Philadelphia, 1943, pp. 445–448, 503, 506.

(*4*) Ostrolenk, M., Kramer, N., and Cleverdon, R. C.: Studies of enterococci and *E. coli.* J. Bact. **51:** 197–203 (1947).

(*5*) Ritter, C., and Treece, L. E.: Sanitary significance of cocci in swimming pools. Am. J. Pub. Health **38:** 1532–1538 (1948).

(*6*) Mallmann, W. L.: A new yardstick for measuring sewage pollution. Sewage Works J. **12:** 875–878 (1940).

(*7*) Hajna, A. A., and Perry, C. A.: Comparative study of presumptive and confirmative media for bacteria of the coliform group and for fecal streptococci. Am. J. Pub. Health **33:** 550–556 (1943).

(*8*) Chapman, G. H.: The isolation of streptococci from mixed cultures. J. Bact. **48:** 113–114 (1944).

(*9*) White, J. C., and Sherman, J. M.: Occurrence of enterococci in milk. J. Bact. **48:** 262 (1944).

(*10*) Winter, E. A., and Sandholzer, L. A.: Recommended procedure for detecting the presence of enterococci. Commercial Fisheries T. L. 2, Fish and Wildlife Service, U. S. Dept. of the Interior, Washington, D. C., 1946.

(*11*) Mallmann, W. L., and Seligmann, E. B.: A comparative study of media for the detection of streptococci in water and sewage. Am. J. Pub. Health **40:** 286–289 (1950).

(*12*) Standard Methods for the Examination of Water and Sewage, ed. 9. American Public Health Association, New York, 1946.

(*13*) Bagger, S. V.: The enterococci. J. Path, and Bact. **29:** 225–238 (1926).

(*14*) Sherman, J.: The streptococci. Bact. Rev. **1–2:** 1–87 (1937).

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended September 1, 1951

Malaria

In reply to a request for additional information on malaria throughout the United States, certain States have reported as follows on cases prior to the current week. Colorado received reports of 169 cases from a military hospital from June 30 to August 25. In Wisconsin, 126 cases, 102 of which were from one military establishment, were reported from January 1 to August 18. Of the 14 civilian cases, 8 are said to have been acquired outside the United States. Twenty-four cases have been reported in Maryland, exclusive of Baltimore, and of these, 23 contracted the infection in Korea, and the remaining 1 from another foreign country. Seven of the twenty-four are classified as civilian cases, but all are returned veterans. Baltimore has received reports of 8 cases in civilian seamen and a like number in military personnel in an Army hospital. Tennessee has reported 85 "Korean malaria cases." Two civilian cases reported recently, which were confirmed by laboratory examination, apparently were infected locally. One was a vivax infection and the other, quartan. It is suggested that the source of infection in the latter may have been mosquitoes which had fed on neurosyphilitic patients who had received treatment. A total of 412 cases among civilians was reported in Texas for the 34 weeks ended August 25, and 114 were reported from military establishments for the 15 weeks ended August 25. Nebraska; Boston, Mass.; and New Orleans, La., reported a few cases each, and Nevada reported none for the past 8 months.

For the current week, each of 24 States reported 1 or more cases of malaria. A total of 127 cases from military establishments and of 55 in civilians was reported. A certain proportion of the latter may have been persons with previous military service. States reporting more than 10 cases were: Missouri, 29; Wisconsin, 25; Oklahoma, 25; Texas, 23; Colorado, 13; and Illinois, 11.

Poliomyelitis

A total of 1,742 cases of poliomyelitis was reported for the current week as compared with 1,770 last week. This suggests that the peak of incidence has been reached for the country as a whole, which is

approximately the same as it was in 1949. In 1950 the peak week was much later than usual—late in September.

For the current week incidence decreased, as compared with the previous week, in the New England, West North Central, East South Central, West South Central, and in the Mountain States. Only slight increases over the previous week occurred in the other parts of the country.

The cumulative total of poliomyelitis cases for the calendar year is 13,632 as compared with 13,480 for the same period in 1950. Since the seasonal low week the cumulative total is 12,420, which is approximately the same as in 1950 (12,349).

Epidemiological Reports

Erythema Infectiosum

Dr. Charles R. Freeble, Jr., Ohio Department of Health, reports an outbreak of approximately 100 cases of erythema infectiosum (also known as Fifth disease) in Cuyahoga County. The cases were first recognized in May; they reached their peak in June and subsided rapidly during July. Dr. A. J. Pearse, Cuyahoga County Health Commissioner, reported that the bulk of the cases were in school-age children with a number of adults and smaller children also evidencing the infection. Multiple cases occurred in some families. The outbreak originated and was fairly well confined to an area of the county where the population has been estimated to include over 25 percent displaced persons recently arrived from central Europe. The outbreak apparently began in this group and soon involved all segments of the population. Early cases were considered to be a mild form of measles or an allergic phenomenon. Several patients experienced a recrudescence of the eruption after apparent recovery. Treatment with antibiotics failed to limit the course of the illness. Apparently no complications or sequelae developed on any of the cases. The absence of posterior cervical lymphadenopathy and normal white differential counts were observed. Later in the course of the outbreak measles began to appear in high incidence, and it was observed that a number of the early cases later developed measles, which inferred a lack of cross immunity. Following the closing of school for the summer, the outbreak gradually subsided. The infection was so mild that many cases were not seen by a physician, and the data presented had to be obtained in retrospect.

Disease of Unknown Etiology

Dr. George W. Cox, Texas State Health Officer, reports an outbreak of illnesses resembling pleurodynia appearing in Fannin County and the nearby area. It is estimated that several thousand cases have occurred. The disease is generally mild, rather self-limited, and of

short duration. Symptoms are frequently severe consisting of fever, 101° to 104°, nausea, vomiting, and particularly pain across the upper abdomen or lower chest. Frequently the patient has complained of difficult or painful breathing. The attack rate is high and the illness has appeared in all age groups. Some of the earlier illnesses were originally thought to be appendicitis because of the localized pain in the lower right quadrant and the sudden onset of fever. Laboratory investigation is proceeding for the isolation of the etiologic agent and includes virus studies of stool and throat washings, and complement fixation and neutralizing tests on paired blood sera. It is surmised at this time there is a probability of Coxsackie infection, possibly of the B type, but proof must await laboratory investigations.

Food Poisoning

Dr. Cox reports an outbreak of food poisoning occurring at Austin, Tex., in a group of missionaries who had two meals at a church. Approximately 30 persons were hospitalized. *Salmonella oranienberg* was found in 48 of 50 stools investigated and in tuna fish, beans, and other food specimens.

Dr. B. N. Diefendorf, New York State Department of Health, has reported a family outbreak of gastroenteritis in Saratoga County, in which canned hamburger was suspected as the vehicle of infection. Although *Staphylococcus aureus* food poisoning was considered probable, laboratory confirmation was lacking.

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Sept. 1, 1951	Sept. 2, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	------	------	------	(1)	(1)	(1)	(1)	46	29	34
Diphtheria (055)	48	82	144	27th	378	545	986	2,386	3,673	5,596
Encephalitis, acute infectious (082)	27	60	28	(1)	(1)	(1)	(1)	687	594	425
Influenza (480–483)	267	294	294	30th	1,332	1,683	1,582	117.387	140,447	130,183
Measles (085)	1,029	701	701	35th	497,612	307,301	586,282	468,911	288,171	551,414
Meningitis, meningococcal (057.0)	51	36	40	37th	3,931	3,630	3,534	2,970	2,717	2,562
Pneumonia (490–493)	427	769	(2)	(1)	(1)	(1)	(1)	46,868	62,131	(2)
Poliomyelitis, acute (080)	1,742	1,625	1,625	11th	12,420	12,349	12,307	13,632	13,480	12,657
Rocky Mountain spotted fever (104)	8	14	16	(1)	(1)	(1)	(1)	273	383	461
Scarlet fever (050) [3]	229	264	290	32d	748	766	973	54,134	40,936	58,324
Smallpox (084)	------	------	------	35th	19	46	71	11	26	50
Tularemia (059)	14	16	15	(1)	(1)	(1)	(1)	469	679	701
Typhoid and paratyphoid fever (040, 041) [4]	98	96	100	11th	1,517	1,821	2,000	1,952	2,331	2,485
Whooping cough (056)	951	1,683	1,683	39th	[5]71,306	111,542	94,320	[5]49,704	90,006	68,302

[1] Not computed.
[2] Data not available.
[3] Including cases reported as streptococcal sore throat.
[4] Including cases reported as salmonellosis.
[5] Addition: Rhode Island, week ended August 18, 4 cases.

Reported Cases of Selected Communicable Diseases: United States, Week Ended September 1, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	48	27	267	1, 029	51	427	1, 742
New England	2	1	1	132	1	9	53
Maine				10	1	1	4
New Hampshire							2
Vermont				7			
Massachusetts	2	1		81			13
Rhode Island			1	16			
Connecticut				18		8	34
Middle Atlantic	9	6		258	9	38	218
New York	6	4	(1)	132	4		119
New Jersey	1	2		85	2	12	45
Pennsylvania	2			41	3	26	54
East North Central	8	9	11	231	12	72	422
Ohio	5			33	3		74
Indiana	2	2	9	3		4	18
Illinois		4	1	92	6	46	128
Michigan		3	1	49	3	22	98
Wisconsin	1			54			104
West North Central	1	3	5	34	6	34	240
Minnesota	1		1			3	35
Iowa				2	1		33
Missouri		1		6	2		64
North Dakota		1	1	14	1	27	5
South Dakota		1		4			14
Nebraska				4			37
Kansas			3	4	2	4	52
South Atlantic	9	1	96	89	8	84	134
Delaware							1
Maryland		1	3	43		19	16
District of Columbia				5		3	6
Virginia	1		76	7	2	20	19
West Virginia				7			19
North Carolina	1			2	2		21
South Carolina	7		1	1	1	1	7
Georgia			16	19	2	41	36
Florida				5	1		9
East South Central	7	1	1	8	3	16	131
Kentucky			1		3	7	20
Tennessee	3	1		6			56
Alabama	2					5	24
Mississippi	2			2		4	31
West South Central	8	1	51	50	5	106	157
Arkansas	1		35	1		9	33
Louisiana					2	4	27
Oklahoma	1		16	3		8	27
Texas	6	1		46	3	85	70
Mountain			82	66	2	25	197
Montana			4	10		3	11
Idaho				6	1		7
Wyoming							5
Colorado					1	10	90
New Mexico				9		1	9
Arizona			78	34		11	36
Utah				7			39
Nevada							
Pacific	4	5	20	161	5	43	190
Washington	2			32			23
Oregon			14	11	1	25	19
California	2	5	6	118	4	18	148
Alaska							4
Hawaii				33		1	

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended September 1, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	8	229		14	98	951	100
New England		22			6	74	
Maine		5			3	12	
New Hampshire							
Vermont		2				12	
Massachusetts		8			3	39	
Rhode Island							
Connecticut		7				11	
Middle Atlantic		32		1	9	152	18
New York		21		1	4	76	10
New Jersey		6			1	46	
Pennsylvania		5			4	30	8
East North Central	1	67		3	10	171	6
Ohio		15			1	34	4
Indiana		2			1	14	
Illinois	1	20		2	2	42	
Michigan		21		1	2	45	
Wisconsin		9			4	36	2
West North Central		11		1	5	71	13
Minnesota		1				2	2
Iowa					1	10	5
Missouri		5			3	18	4
North Dakota						4	
South Dakota					1	2	
Nebraska						4	2
Kansas		5		1		31	
South Atlantic	4	25		3	19	122	15
Delaware		1					
Maryland	2	1				7	
District of Columbia		4					
Virginia	2	4				18	5
West Virginia		1			8	40	3
North Carolina		13			3	21	
South Carolina				2	3		3
Georgia		1		1	5	24	4
Florida						12	
East South Central	2	26		1	14	51	28
Kentucky		5			5	18	18
Tennessee	1	13			7	19	3
Alabama	1	5				11	4
Mississippi		3		1	2	3	3
West South Central		6		2	11	194	19
Arkansas		1		1	1	10	4
Louisiana					2		
Oklahoma		2			2	10	2
Texas		3		1	6	174	13
Mountain	1	7		1	4	41	
Montana		1				1	
Idaho						3	
Wyoming				1			
Colorado		1			2	19	
New Mexico					2	7	
Arizona		1				10	
Utah	1	4				1	
Nevada							
Pacific		33		2	20	75	1
Washington		1				3	
Oregon		3			1	6	
California		29		2	19	66	1
Alaska							
Hawaii							

[1] Including cases reported as streptococcal sore throat.

[2] Including cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended August 18, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	6					5	1				
Chickenpox	172	2		6		17	81	9	18	30	9
Diphtheria	2					2					
Dysentery, bacillary	14					9		2			3
Encephalitis, infectious	1								1		
German measles	99			7		13	37	2	17	13	10
Influenza	22			17			2				3
Measles	339	2		40		124	37	10	23	70	33
Meningitis, meningococcal	1						1				
Mumps	116	2		2		26	34	10	20	9	13
Poliomyelitis	170	2		10		14	125		8	8	3
Scarlet fever	78	2			1	25	8	12	7	7	16
Tuberculosis (all forms)	210	30		1	2	94	26	24	11	11	11
Typhoid and paratyphoid fever	20	1				15	2				2
Venereal diseases:											
Gonorrhea	250	1		10		61	51	16	25	32	54
Syphilis	60			4	5	25	18	2		3	3
Primary	7					2	3			2	
Secondary	1						1				
Other	52			4	5	23	14	2		1	3
Other forms	1					1					
Whooping cough	157			1	2	51	52	7	9	8	27

CUBA

Reported Cases of Certain Diseases—4 Weeks Ended July 28, 1951

Disease	Total	Pinar del Rio	Habana		Matanzas	Santa Clara	Camaguey	Oriente
			Habana City	Total				
Cancer	64	2		10	12	24		16
Chickenpox	3		2	2				1
Diphtheria	7		5	5	2			
Leprosy	6			5				1
Malaria	16		1	1				15
Measles	35		15	15			14	6
Tuberculosis	67			5	10	22	8	22
Typhoid fever	40	3	2	3	1	12	5	16

MADAGASCAR

Reported Cases of Certain Diseases and Deaths

June 1951

Disease	Aliens		Natives	
	Cases	Deaths	Cases	Deaths
Beriberi			1	1
Bilharziasis	1		6	
Dysentery:				
Amebic			22	
Bacillary	2		6	
Erysipelas			2	
Influenza	36		5, 115	7
Leprosy	1		13	
Malaria	139	1	19, 484	60
Measles	33		200	
Mumps			89	
Plague			1	
Pneumonia (all forms)	2		555	52
Puerperal infection			2	
Tuberculosis, respiratory	2		66	9
Typhoid fever	1		8	1
Whooping cough	7		190	7

July 1951

Disease	Aliens		Natives	
	Cases	Deaths	Cases	Deaths
Beriberi			1	1
Bilharziasis	1		17	
Diphtheria	2	1	3	
Dysentery, amebic	4		76	3
Erysipelas			3	
Influenza	6		4, 821	18
Leprosy	1	1	18	
Malaria	99		26, 847	65
Measles	34		76	
Meningitis, meningococcal	1		1	
Mumps			46	
Plague			6	6
Pneumonia (all forms)			639	70
Puerperal infection			7	
Trachoma			1	
Tuberculosis, respiratory	3		88	10
Typhoid fever	3		4	
Whooping cough	1		194	3

Note.—No report was received from Madagascar for May 1951.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Cholera

Burma. A total of 12 cases of cholera was reported in Tavoy for August 12–18. These are the first cases reported.

India (French). A total of 66 cases and 33 deaths from cholera was reported for July 21–31 for French India. Included in the total are 8 cases and 4 deaths in Pondicherry, 57 cases and 29 deaths in

Pondicherry dependencies, and 1 first case in Yanaon. For the period August 1–10, 20 cases were reported in Pondicherry.

Plague

India. In Mysore, for the period June 29–August 4, a total of 58 cases and 14 deaths was reported. For August 5–11, a total of 43 cases and 21 deaths was reported.

Indochina. For the period August 5–11, a total of two cases of plague was reported in Phanthiet.

Madagascar. For the period August 1–10, a total of three cases and three deaths was reported; and for the period August 11–20, a total of two cases and one death was reported.

Smallpox

Cameroons (French). For the period August 1–10, a total of 14 cases was reported. Included in the total were 7 cases in Benove, and 5 in Marguiwandala.

French West Africa. For the period August 1–10, a total of 162 cases and 31 deaths from smallpox was reported. The total included 13 cases previously reported for the same period from Upper Volta. For the period August 11–20, 9 cases and 1 death were reported from Dahomey.

Gold Coast. For July 2, in the Wa district, a total of one case and one death was reported.

Typhus Fever

Egypt. For the period August 5–11, one case of typhus fever was reported in Cairo.

Iran. For the period July 14–20, preliminary reports give one case and one death from typhus fever in Ahvaz. For the period July 21–27, preliminary reports of typhus fever give one case in Malayer and one case in Tauriz.

New Caledonia. For the period July 1–10, one case of typhus fever was reported.

Tunisia. For the period July 11–20, one case of typhus fever was reported in Beja. And for the period July 21–31, three cases of typhus were reported in Gafsa.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price $4.75 a year; $6.25 foreign.

Public Health Reports

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Age Incidence of Specific Causes of Illness Found in Monthly Canvasses of Families

—Sample of the Eastern Health District of Baltimore, 1938–43—

By SELWYN D. COLLINS, Ph.D., F. RUTH PHILLIPS, and DOROTHY S. OLIVER*

There are a number of ways to describe the illness situation in a given population: the incidence and prevalence of illness by age and sex; the seasonal variation in the case load; variation with economic, occupational, or social status; variation with climatic and weather conditions; and variation with other characteristics. But the one item that tells most about a given illness and also about the nature and the burden of the case load in a given population is the diagnosis of the case. The diagnosis usually gives a general idea of the expected duration of the disease, whether recovery is probable, and, if so, whether it will be complete or leave the patient permanently impaired.

Because of these facts, some of the papers on illness in a sample of the Eastern Health District of Baltimore deal with more or less specific diagnoses rather than broader groups of diseases. This particular study sets up curves to indicate the ages most affected by any specific disease with enough cases reported in the survey to give reasonably accurate results.[1]

A preceding study in this series dealt with specific causes of illness among persons of all ages (*2*) with considerable detail about the selection of the population sample and a comparison of its various characteristics with other urban groups. Suffice it to say here that the sample under discussion included 21,505 full-time person-years of observation of white residents of the original Eastern Health District (Wards 6 and 7) of Baltimore, who were visited at monthly intervals to obtain from the household informant (usually the housewife) records

*From the Division of Public Health Methods, Public Health Service. The Milbank Memorial Fund, the Departments of Biostatistics and Epidemiology of the Johns Hopkins School of Hygiene and Public Health, and the Baltimore City Health Department cooperated in the study. Grateful acknowledgment is made to Jean Downes of the Milbank research staff who participated in all phases of the Baltimore Morbidity Survey.

[1] In some respects this paper duplicates some of the data in preceding studies (*4, 5*). However, the present study deals primarily with specific diagnoses with special reference to durations of cases during the whole study and to rates among the very old and the very young.

of illness of all types, disabling and nondisabling, accident and disease, among the members of the family.

The preceding study (2) included for specific diagnoses the rates for various types of illness such as the total cases reported to the interviewers; the disabling cases, defined as those that kept the patient from gainful work, school, housework, or other usual activities; the average annual days of such disability per person observed; the average days of disability per disabling case; cases that confined the patient to the house, and cases that confined to bed for 1 or more days.

The present study deals largely with total cases (both disabling and nondisabling) of specific diagnoses for persons of various ages. However, some consideration is given to the age variation in several types of rates such as those for disabling acute and chronic cases and days from all diagnoses combined.

Disabling Illness From Acute and Chronic Diseases

In the Baltimore study there was an annual rate of 650 disabling cases per 1,000 canvassed population, consisting of acute cases of disease and accident and of disabling attacks or episodes of chronic disease. The acute and chronic diseases are different in many ways. The acute diseases are predominant in the younger ages but the chronic diseases are important among the aged; the acute occur in large numbers but are of short duration, with complete recovery as the usual termination. Although the chronic occur less frequently they are important because of their long durations and frequent permanent residual effects or fatal termination. Thus, there is an extremely uneven burden of chronic illness; the relatively few afflicted individuals tend to be of the older ages when they are least able to bear the expense of thorough treatment with long hospitalization and other medical care.

The annual frequency of cases of illness at specific ages does not describe the whole situation. In fact, frequency of cases can be expressed in several different ways:

1. Incidence measures the rate of new cases with onset during the study period. In view of the insidious character of the onset of many chronic diseases, it is hard to fix the original date of onset of the disease, but it is usually feasible to determine when the patient was first disabled or when the particular disease was first diagnosed by a doctor. The figure for the annual new cases (incidence) of specific chronic diseases per 1,000 population seems to be the most useful rate for control and measurement purposes. However, new cases of chronic diseases are not large in frequency although long in duration.

2. In the absence of data for a large population, prevalence of chronic disease on a given day may be useful.

3. The total number of patients suffering from a given chronic

disease during the study period (regardless of date of onset) is obtainable and may be of considerable value since this rate measures the case or treatment load for the year.

4. Another measure of chronic disease is the number of disabling attacks or episodes occurring during the study period. In terms of all causes of illness, this measure of disabling attacks within a given time would seem directly comparable with the number of cases or attacks of acute diseases. However, in studies covering several years it occasionally happens that one individual may suffer as many as 30 or more attacks or episodes of a given chronic disease, and like any extreme item in a distribution, it may bias considerably the curve of age specific case rates. It is for this reason that for some diseases and in some situations broader age intervals have been used in the age curves (table 2).

In the present study where numbers are not large, chronic disabling cases have been tabulated in terms of disabling attacks or episodes. An important supplementary rate also shown is the annual days of disability per person observed, a rate which seems to be free from the biases mentioned above.

Figure 1 and table 1 show age-specific rates of various kinds for all causes, for acute diseases and accidents, and for chronic diseases. It should be noted that these age curves are on a relative basis; the curves represent ratios of the rate in each age to the rate for all ages, but the vertical rate scales are labeled in actual disabling cases per 1,000 persons or in days of disability per person observed.

The top section of figure 1 shows rates for all types of cases for all causes. It is seen here that the frequency of cases from all causes is high in the younger ages but relatively low in the older, whereas the prevalence curve and the days lost per person observed show the opposite, that is, rather low rates among children and youth and high rates among older persons.

Although the disabling prevalence per 1,000 population observed is obtained from a count of disabled persons on a given day, it may also be thought of as the number of days of disability out of 1,000 person-days of life, that is, one person-day for each individual covered by the interview. Of course this interpretation neglects the fact that a person who was not disabled when interviewed may later in the day become sick or even die. However, the error from such occurrences would be small. Considering prevalence in this way, one would expect its relative age curve to resemble in its general aspects, as it does, that of the days of disability per person observed; both curves represent days—the one a count of all disabled days within the period that the individual was under observation, and the other, prevalence, a sample of one day (date of visit) from each month that the individual was under observation.

Table 1. *Illness rates* [1] *of various kinds from all causes among white persons of specific ages canvassed at monthly intervals in a sample of the Eastern Health District of Baltimore, 1938–43*

[Disabling cases; sole and primary causes only]

Type of case	All ages: Number cases or days	All ages: Rate	Age: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65–74	75 and over
	Annual frequency of disabling cases per 1,000 population [2]												
All	13,987	650	1,377	1,308	786	473	479	490	507	495	574	551	531
Acute	12,363	575	1,370	1,278	733	450	454	457	414	372	383	329	233
Chronic	1,624	75.6	7.5	29.6	52 7	23.3	25.0	33.5	92.7	122.5	191.1	222.2	297.7
Temporary [1]	1,412	65.7	5.6	23.3	47.0	21 4	18.8	29.2	85.1	110.5	167.1	185.2	216.8
Permanent [1]	212	9.9	1 9	6 3	5.7	1.9	6.2	4.3	7.6	12 0	24.0	37.0	80 9
	Average prevalence of disabling cases per 1,000 population [2]												
All	9,443	36.6	41.2	50.3	38.4	22.3	28 2	23.1	25.7	30 3	58.1	78.9	164 9
Acute	4,212	16.3	40 1	39.3	18.6	11.5	13 7	13 4	13.1	9.3	7.7	7.1	15 4
Chronic	5,231	20 3	1 1	11 0	19.8	10 8	14 5	9.7	12 6	21.0	50.4	71.8	149.5
	Annual days of disability per person observed [2]												
All	341,523	15.9	15.5	19.3	13.4	7.2	9.4	9 0	11.8	17 3	29.9	41 3	71.9
Acute	127,210	5 9	12 8	11.9	5 2	3.7	4.9	4.7	5.0	4 5	5.3	5.6	6 0
Chronic	214,313	10 0	2.7	7 4	8.2	3.5	4.5	4.3	6 8	12 8	24.6	35 7	65 9
Temporary	60,850	2.91	.39	2.23	2.78	1.63	.78	1.05	2.58	3.89	6.07	11.09	11.59
Permanent	153,463	7.05	2.28	5.15	5.45	1.91	3.77	3.28	4 23	8.86	18.53	24.64	54.29
	Days of disability per disabling case												
All	13,987	24.4	11.2	14.8	17.1	15.2	19.8	18.3	23 3	34.8	52.2	75.0	135.5
Acute	12,363	10.3	9.3	9.3	7.1	8.1	10 9	10.2	12.0	12.0	13.9	17.1	25.9
Chronic	1,624	132	355	249	156	152	182	130	74	104	129	161	221
Temporary	1,412	43	70	71		61		36	30	35	36	58	
Permanent	212	724	1,212	884		697		773	560	736	771	665	671

[1] Cases in this table represent disabling attacks or episodes of acute and of chronic diseases. Thus, acute and chronic cases are on the same basis, and the same individual may have had more than one attack or episode of the same acute or chronic disease within a given study period. All tabulations for all causes (including all acute cases and all chronic attacks) count cases (periods of disability) and days of disability only once, regardless of the number of diagnoses it requires to describe the diseases from which the patient is suffering.

Chronic permanent disabling cases consist of those in which the patient was disabled throughout the period of his observation. Other chronic disabling cases are classified as chronic temporary attacks or episodes, some of which had their onset of disability prior to the time the patient entered the study. For all causes combined the great majority of the disabling cases are acute with onset within the patient's period of observation. Thus, the combined age curve for cases of all causes resembles the frequency of acute disabling cases more closely than the age curve of disabling prevalence.

Days of disability per person observed counts the days within the study period only, without respect to dates of onset or termination of the disability. Thus, this day rate for chronic diseases is the same whether it is counted as the total days of disability suffered during a given time by an individual with a chronic disease or whether it refers to the disability summated from the disabling attacks or episodes.

[2] Rates, except prevalence, are based on full-time years of life observed (see table 2); prevalence rates are weighted averages of prevalence for the 60 months of the survey, the weights being proportional to the number of individuals covered by the interviews during the month. That is, the population used was the total individuals covered by the interviews, and the cases were the total persons who were reported as disabled at the time of the interview. The total interviews (populations) for computing prevalence rates were: All ages, 258,067; under 5, 19,145; 5–9, 19,026; 10–14, 20,954; 15–19, 24,640; 20–24, 23,046; 25–34, 45,163; 35–44, 38,071; 45–54, 32,889; 55–64, 19,968; 65–74, 11,335; 75 and over, 3,712.

The last measure, days of disability per disabling case, rises continuously with age, the youngest age groups having the shortest durations per case for all causes. The reason appears to be that in the early ages the short-duration acute cases dominate the situation,

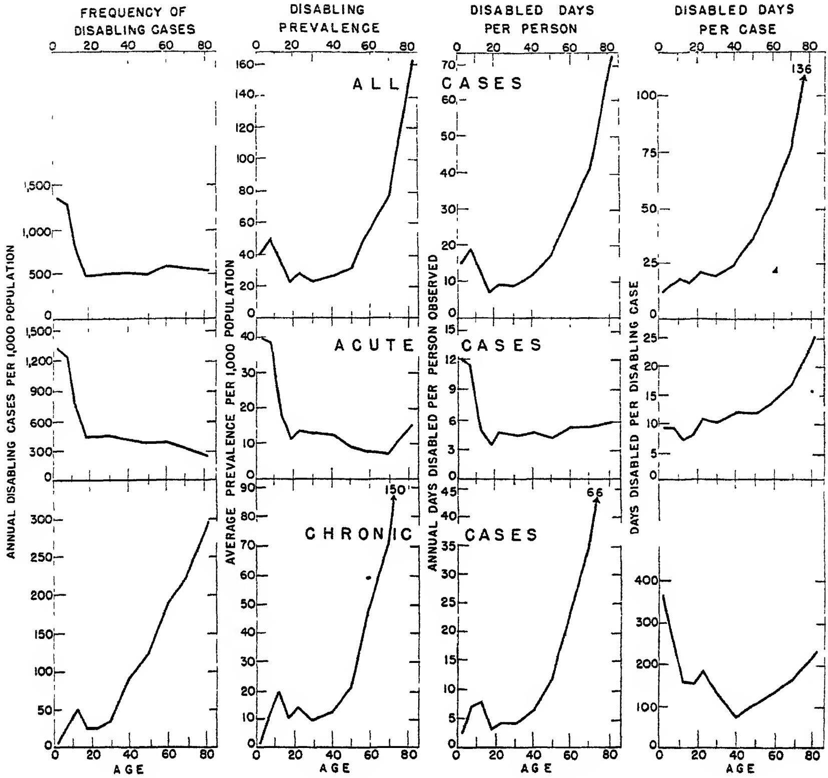

Figure 1. Age variation in rates of acute and chronic disabling illness from all causes as measured by case frequency, prevalence, and by days per person observed and per case—Eastern Health District of Baltimore, 1938–43.

NOTE: Both acute and chronic cases or attacks are represented by periods of disability with onset within the study period, except for the chronic permanent and some chronic temporary cases. See note to figure 2 for further definitions.

Throughout this paper the vertical rate scales on the charts change for the different diseases or types of cases. However, in all instances, the rate for both sexes of all ages represents on the vertical rate scale a distance equal to 30 years on the horizontal age scale. Thus the curves are on a relative basis like a curve representing the ratio of the rate in each age to the rate for all ages combined. However, the vertical rate scales have been put on in terms of actual rates and disabling days.

but in the older ages the long-duration chronic diseases are more important.

When the acute and chronic conditions are viewed separately, the age curves for these two types of illness are quite different. However, the three kinds of measures—frequency, prevalence, and days of disability—are similar in their general outlines for acute cases and for chronic cases. Thus the age curve for the mixture of acute and chronic diseases does not give a true picture of the real situation because the component parts lack homogeneity.

Even the breakdown into acute and chronic diseases is too crude for all purposes. Figure 2 illustrates in a rough way the age selection of chronic temporary cases and days of disability, as compared with

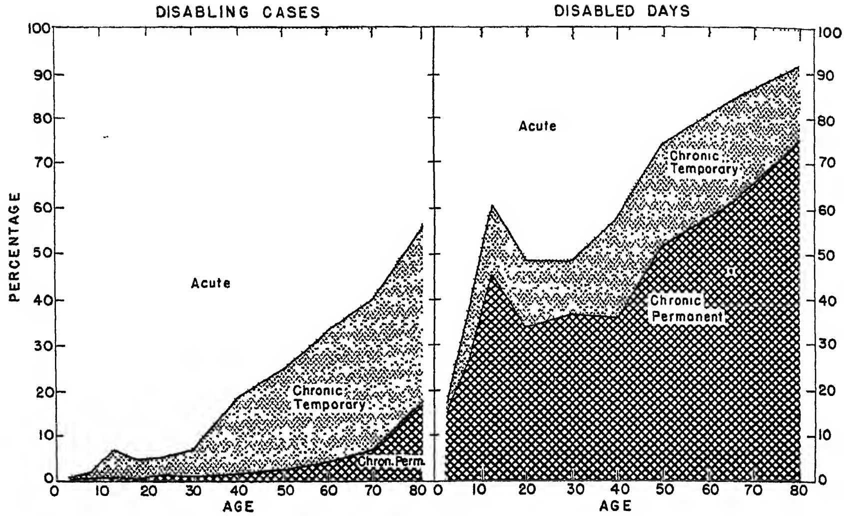

Figure 2. Age variation in the proportion of cases and of days of disabling illness from all causes classified as acute disability, chronic temporary disability, and chronic permanent disability—Eastern Health District of Baltimore, 1938–43.

NOTE: Chronic permanent disability refers to those cases which disabled throughout the period of the patient's observation; other chronic cases are classified as chronic temporary disability.

chronic permanent and with acute cases and days. On the left of figure 2, the data show for specific ages what proportion of the disabling cases or episodes were acute, chronic temporary, and chronic permanent. The right half of the figure shows the same data for days of disability. Chronic permanent disability pertains to patients who were disabled when the family entered the study and throughout the time that they were under observation. Chronic temporary disability refers to chronic patients who were well enough to be about their work or other usual activities for a part of their period of observation.

At no age under 30 years do the chronic disabling cases or attacks constitute as much as 7 percent of the disabling case load, and even at 75 years and over they constitute only 56 percent of the disabling cases. As one would expect, the picture for days of disability is quite different from that for cases or attacks. Under 5 years of age, 83 percent of the days of disability were due to acute diseases; from 5 to 35 years, an average of about half of the disabled days were acute; above 35 years the percentage of days of disability that represent chronic cases rises rapidly until for the group over 75 years, only 8 percent of the days of disability were due to acute diseases. However, the percentage of days of disability due to chronic temporary cases is not so large; from 5 to 35 years of age the chronic temporary days of disability constitute less than one-third of the total chronic days of disability; above 35 years the rise in the percentage of disabled

days due to chronic disease comes largely from chronic permanent disability, and at 75 years and over, 75 percent of all days of disability are due to chronic permanent disability.

Considering all ages combined, acute disabling cases constituted 88 percent of all disabling cases, but their days of disability accounted for only 37 percent of all days of disability; chronic temporary cases constituted 10 percent of all disabling cases but 19 percent of days of disability; chronic permanent cases (including institutional) constituted 2 percent of all disabling cases and 44 percent of all days of disability.

Figure 3 shows a number of age curves for chronic temporary and chronic permanent cases and days of disability and for acute cases and days of disability. As in figure 1, these curves are on a relative basis, but the actual rates have been put on the vertical rate scales.

It is seen in the left and center columns of figure 3 that acute case and day rates show considerably less variation with age than either type of chronic case and day rates. The days of disability per chronic disabling case show exceptionally long durations of disability, particularly for the chronic permanent cases. However, this chronic permanent duration really represents the person-days of life observed, since by definition the patients in this permanent category were disabled throughout their period of observation. Nevertheless, it is of interest that in a random selection of households there should be so much time lost because of what might be roughly designated as invalidity. The tremendous difference in actual durations for the three types of cases is indicated by the averages for all ages: acute disabling cases averaged 10 days of disability per case; chronic temporary disabling cases averaged 43 days of disability per case; and the chronic permanent disabling cases averaged 724 days of disability per case. Of the latter category, the 38 institutional cases averaged 796 days of disability as compared with 708 days for the 174 noninstitutional chronic permanent disabling cases.

Age-Specific Rates for Detailed Diagnoses

In the Baltimore survey, the total annual case rate (nondisabling and disabling)[2] was 1,379 per 1,000 population. More than half of the patients, 729 per 1,000, were not disabled in the sense of being unable to work, attend school, do housework, or pursue other usual activities. There are a considerable number of diseases for which the cases are rather largely nondisabling; for example, the allergies except asthma; the minor skin diseases; and some minor communicable diseases, particularly among children. Also, many of the

[2] In this study disabling and nondisabling chronic cases are represented by disabling attacks or episodes plus a count of chronic cases that did not cause disability at any time during the period of observation of the patient.

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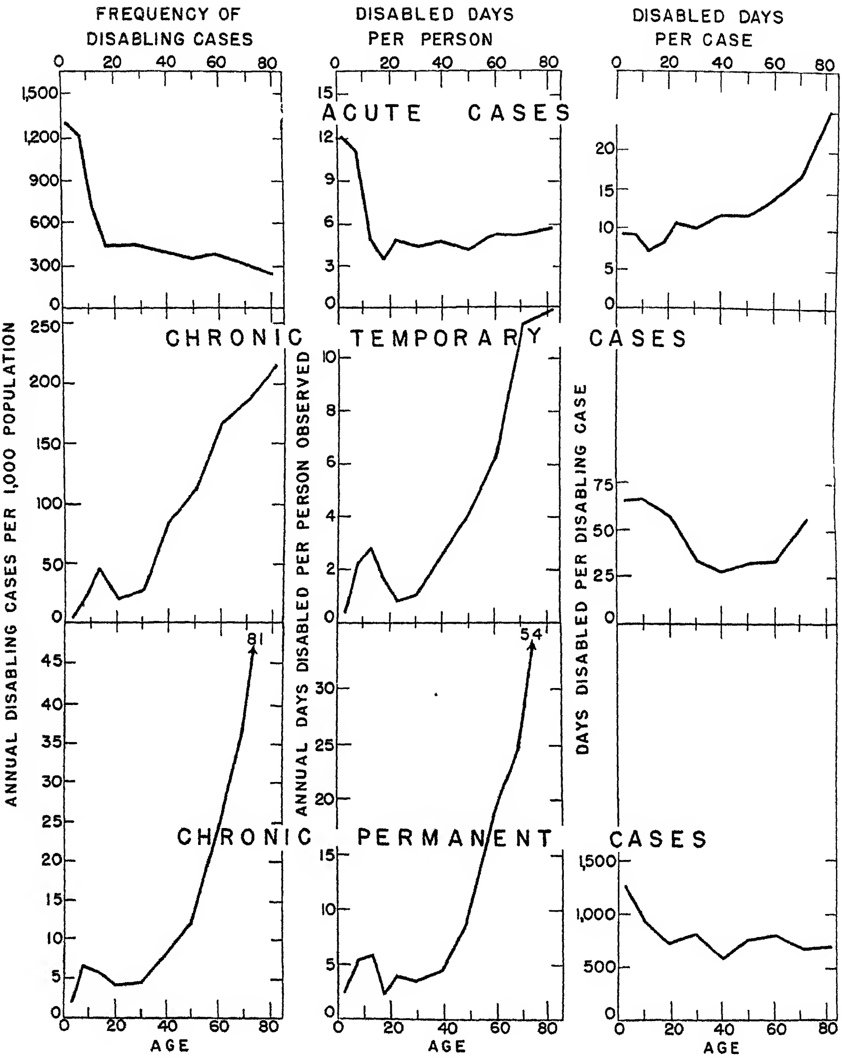


Figure 3. Age variation in rates of acute disability, chronic temporary disability, and chronic permanent disability as measured in cases and days—Eastern Health District of Baltimore, 1938–43.

serious chronic diseases, such as those of the heart and arteries, may cause relatively little disability but may end in a sudden and fatal attack (*1*).

Table 2 shows by age the case rates for each of the diseases shown in the charts.

The rate in the Baltimore Eastern Health District survey for all cases (disabling plus nondisabling) was higher than that found in most other surveys in which the Public Health Service has participated (*2*).

The highest total case rates occurred in the younger ages. Generally, the less serious the cases in terms of disability or time in bed, the greater the excess in the Baltimore survey rates over those found in other similar studies. Thus the more frequent interviews in Baltimore and perhaps the greater care to list all illness occurring in the family, apparently led to relatively greater increases in reports of the less serious types of illness than in reports of the more serious kinds.

The rates in the older ages are higher and a higher proportion of the cases are disabling; whether we use disabling or total cases, the rates for the specific chronic diseases are relatively high in the older ages.

In view of the finding in the Baltimore study that nondisabling cases constitute at least half of all cases of illness, it seemed worthwhile to set up age curves including all recorded cases of each specific diagnosis. In the acute communicable diseases, the mild cases and even the carriers, of which we have no record in this study, are important in the spread of disease. The minor noncommunicable diseases such as those included in this study are also of interest in view of the importance of early diagnosis.

The case rates for specific diagnoses are shown in figures 4, 5, 6, and 7. The age curves are so different, even for diagnoses within rather homogeneous groups such as the minor respiratory diseases, that they are shown here in as much detail as possible. The side scales on these charts represent actual annual case rates but they are so arranged that the average rate for all ages plots at the same distance from the base line for every disease. Thus, the curves are on a relative basis even though the vertical scales show actual rates.

Figures 4–7 readily show that the incidence of many diseases varies with age a great deal more than does the incidence of all causes combined. Since illness from all causes is the sum of the individual causes, this would be expected; nevertheless, it is a reminder of how little knowledge can be obtained about illness when the diagnosis or cause of the condition is not taken into account.

The respiratory diseases and some of the allergies occur very frequently in the ages under 15, and tend to decline as age increases (fig. 4). With a few exceptions the rates for the ages under 5 years are strikingly high. Rates for tonsillectomy and dermatitis venenata (plant poisoning) reach their peaks at 5 to 14 years. Presumably, the reason for the delayed peak in tonsillectomy is the general feeling in the medical profession that it is unwise to remove tonsils at too early an age. The peak for plant poisoning may depend partly upon the character of the neighborhood; in places where poison ivy and other poision plants are common, the peak incidence may be at earlier ages than in areas with fewer poison plants.

Figure 5 shows the digestive diseases and some of the chronic

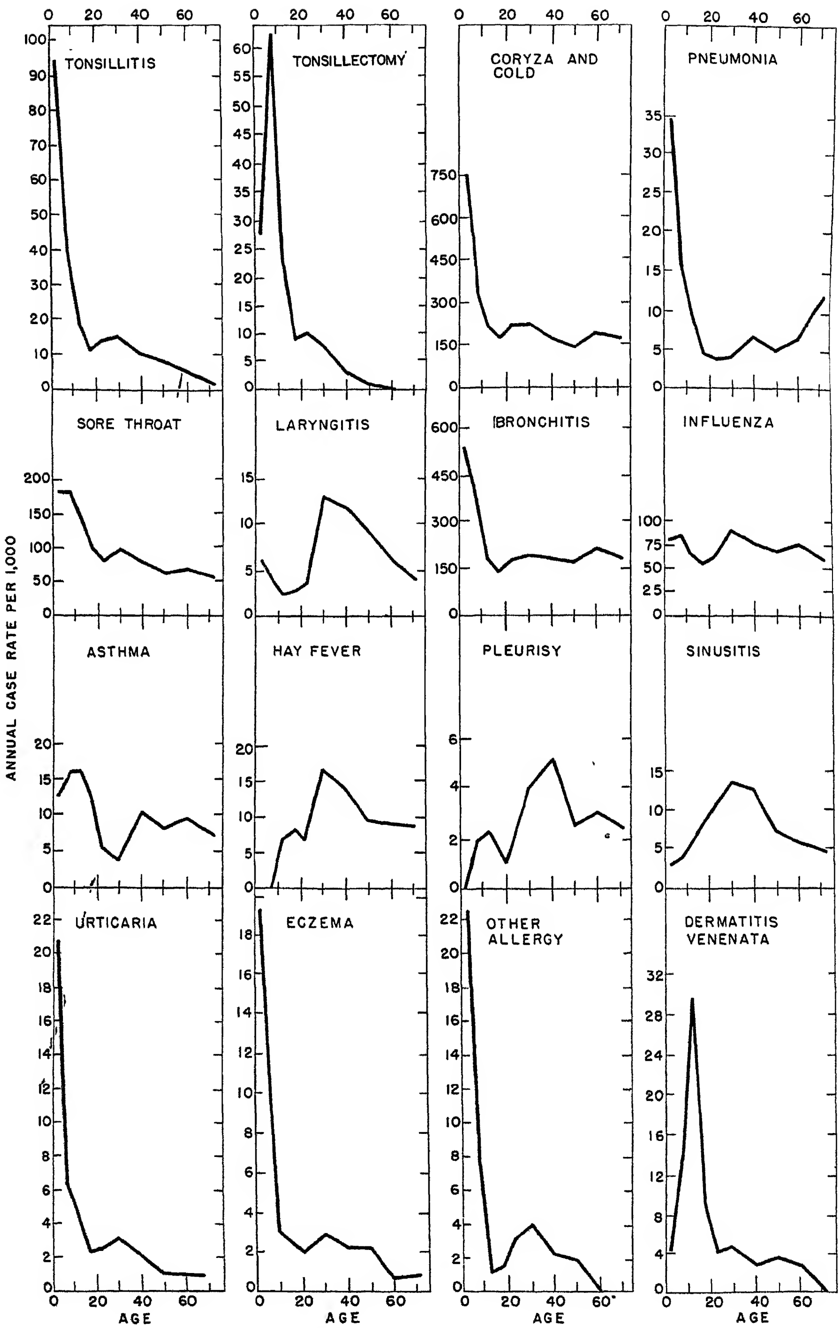


Figure 4. Age variation in total case rates (disabling and nondisabling) from specific causes—Eastern Health District of Baltimore, 1938–43.

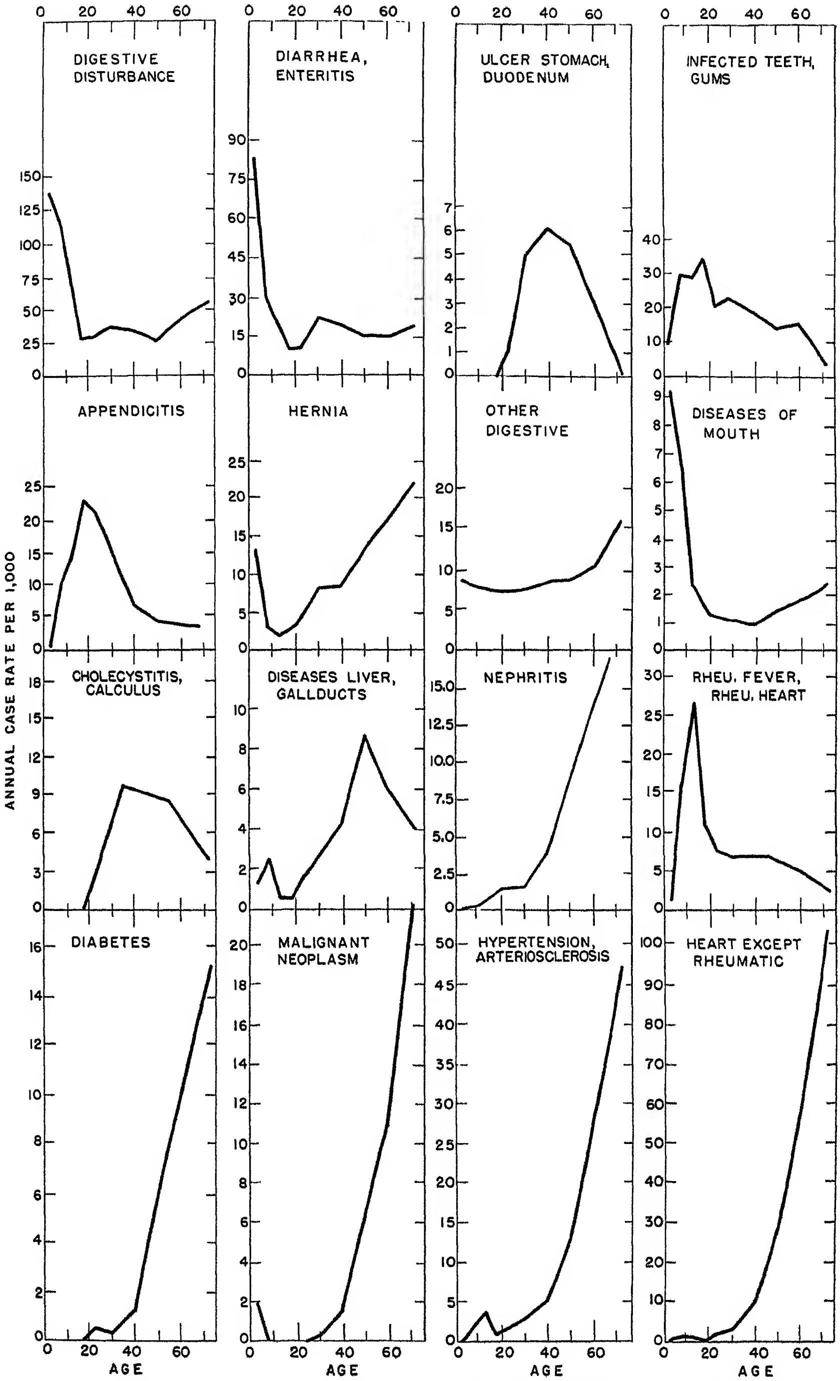


Figure 5. Age variation in total case rates (disabling and nondisabling) from specific causes—Eastern Health District of Baltimore, 1938–43.

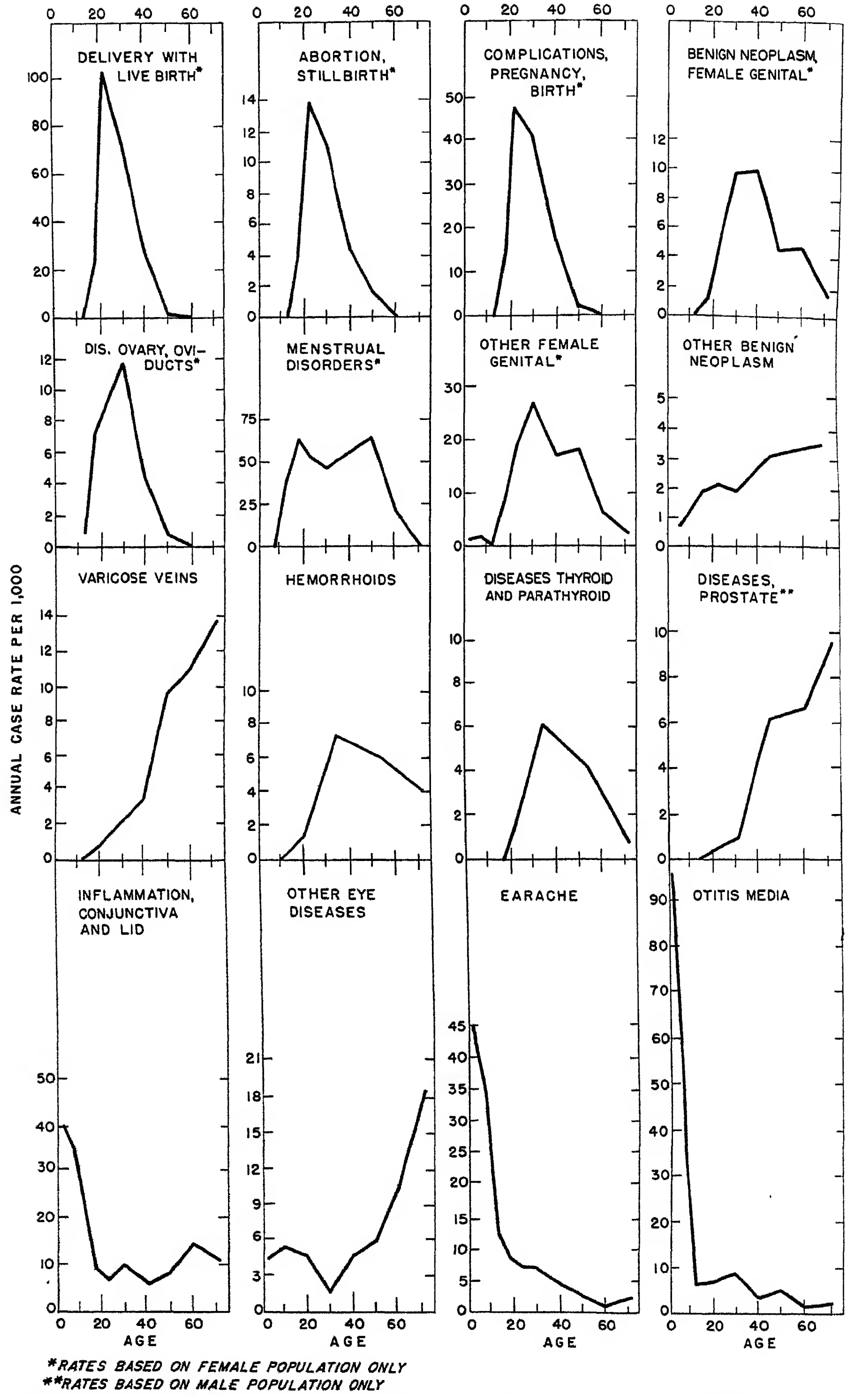


Figure 6. Age variation in total case rates (disabling and nondisabling) from specific causes—Eastern Health District of Baltimore, 1938–43.

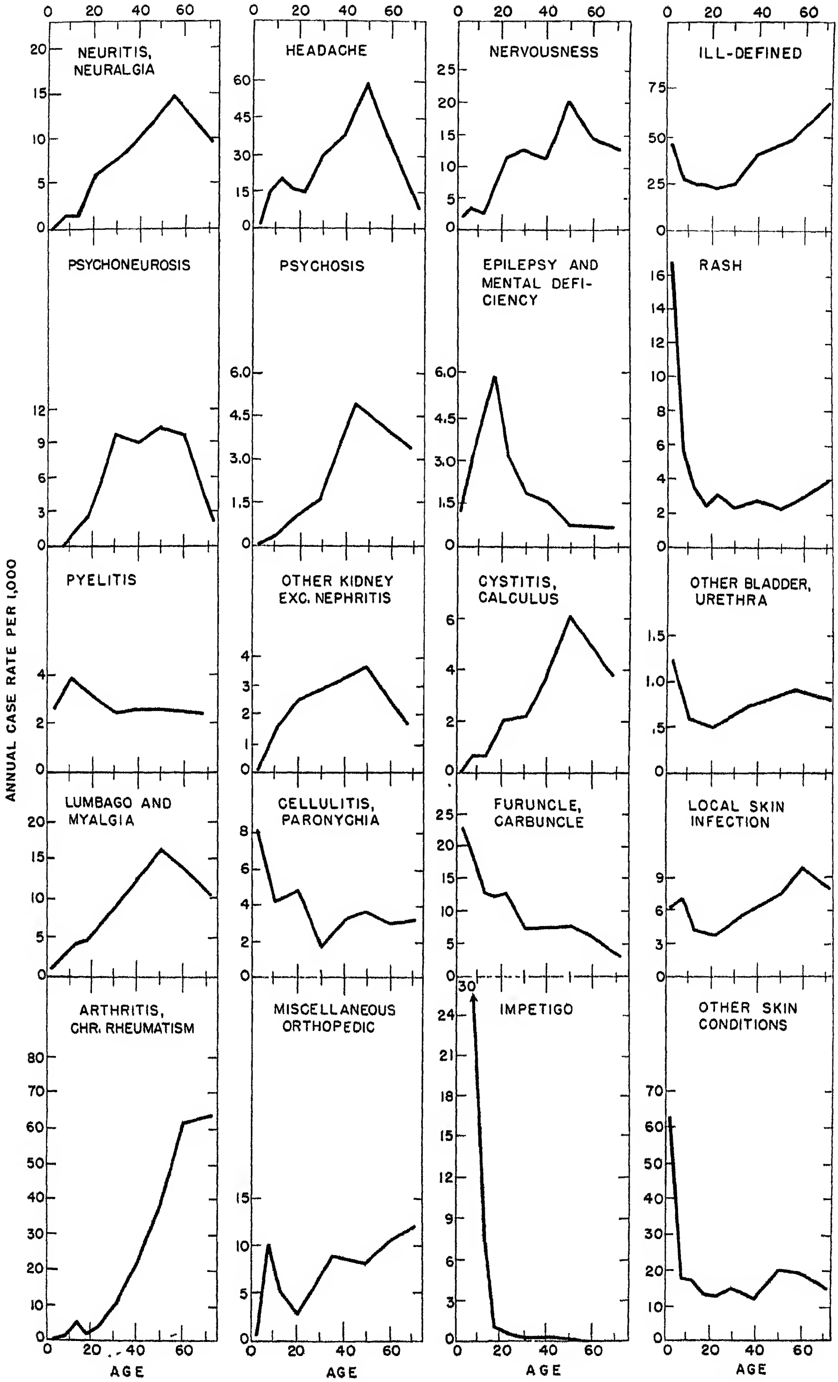


Figure 7. Age variation in total case rates (disabling and nondisabling) from specific causes—Eastern Health District of Baltimore, 1938–43.

diseases. As would be expected, the chronic disease rates are generally low in the younger ages and are successively higher as age increases. The minor digestive diseases, such as digestive disturbances and diarrhea and enteritis, again tend to be high in childhood, but peptic ulcer, appendicitis, and cholecystitis are high among young and middle-aged adults; low rates prevail for both children and the aged.

The upper half of figure 6 pertains to diseases of pregnancy, childbirth, and the puerperal state, and to diseases of the female genital organs. These rates are based on the total female population (married and single). As would be expected, the female genital as well as the puerperal conditions are confined largely to the childbearing ages. Tumors and cysts of the female genital organs are listed in table 2 along with other benign and malignant tumors.

In considering the rather high rates for the complications of pregnancy, childbirth, and the puerperium, it should be remembered that more than one such attack may occur during pregnancy and more than one during the puerperium. Thus, a rate half as large as the birth rate does not necessarily mean that half the women had one or more of these complications.

In the lower part of figure 6 are the various diseases of the eye and ear, including inflammatory diseases, which show the highest rates in the youngest ages. The diseases of the eye are a good example of the necessity for considering specific diagnoses rather than broad groups; conjunctivitis and inflammation of the lid is much more common in the ages under 5 years, but miscellaneous other eye diseases are highest in the oldest ages.

Figure 7 contains a miscellaneous group of diseases including mental and nervous conditions. Evidence from other sources indicates that institutionalized cases of psychosis increase with age, the highest rates occurring in the oldest ages (*3*, *6*, *7*, *8*). However, in this study the psychosis rates increase up to 40 or 50 years of age and then decrease. This may be a chance fluctuation due to the small numbers of cases, or it may reflect the inability to obtain a record by house-to-house canvass for patients of the older ages who may have been in mental hospitals for many years. In the childhood and early adult ages, the records are presumably more complete because each housewife was asked about the residence of all children of the household head whether present in the household or living elsewhere. This question identified the children of the household head who were in mental institutions but did not obtain the same information on brothers, sisters, and parents of household heads who may have been in institutions for such long periods that they had ceased to be considered as members of the family.

The middle part of figure 7 shows various other diseases including kidney, bladder, skin, and orthopedic conditions. The most frequent

Table 2. Annual case rates[1] per 1,000 white persons of specific ages canvassed at monthly intervals in a sample of the Eastern Health District of Baltimore, 1938–43

[Sole, primary, and contributory causes[2] total cases including both disabling and nondisabling]

Diagnoses with code numbers[3]	All ages		Age									
	Number of cases	Rate	Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
Minor respiratory diseases:												
Influenza and grippe (430)	1,550	72.08	79.62	82.60	63.00	54.55	61.46	87.94	75 64	66 76	74.52	59.01
Bronchitis (471,479)	4,669	217.11	529.78	361.92	176.98	136.39	170.83	191.29	181.53	168 19	210.94	179.43
Coryza and cold (440)	5,165	240.18	746.71	329.76	210.19	175.84	217.19	220.78	171.76	143.01	191.71	173.05
Tonsillitis (460)	418	19.44	94.67	39.72	18.90	11.20	14.06	15.14	10.09	8.03	4.81	1.59
Sore throat (461, 466)	2,187	101.70	189.34	184.11	142.61	100.34	80.73	98.57	80.05	63.12	69.11	55.82
Laryngitis (467)	165	7.67	6.27	3.78	2.29	2.92	3.65	13.55	12.29	9.49	6.61	3.99
Other respiratory diseases:												
Sinusitis (495)	187	8.70	3.13	3.78	7.37		10.94	13.55	12.61	7.30	6.01	4.78
Pneumonia (481–489)	186	8.65	33.86	15.76	8.59	4.38	3.65	3.99	6.62	5.11	6.61	11.96
Pleurisy (490–493)	57	2.65	--------	1.89	2.29	1.01		3.99	5.04	2.55	3.00	2.39
Tonsillectomy (450)	262	12.18	27.59	63.68	22.91	8.77	9.90	7.70	2.84	.73	--------	--------
Allergy and related disorders:												
Asthma (501)	202	9.39	12.54	15.76	16.04	12.18	5.21	3.72	10.40	8.03	9.62	7.18
Hay fever (500)	200	9 30	--------	--------	6.87	8.28	6.77	16 47	13.87	9.49	9.01	8.77
Eczema (710)	74	3.44	19.44	3.00		1.76		2.92	2.21	2.19	.60	.80
Urticaria (714)	86	4.00	20.69	6.31	4.58	2.44	2.60	3 19	2 21	1.09	1.03	
Other allergy (791–793)	86	4.00	22.57	7.57	1.15	1.46	3.12	3.99	2.21	1.82	--------	--------
Dermatitis venenata (718)	152	7.07	4.39	13 87	30.93	9.25	4.17	4.78	2.84	3 65	3.00	--------
Infectious and parasitic diseases:												
Measles (013)	345	16.04	110.34	94.58	5.15	.97	1.41		----			
German measles (014)	346	16 09	45.77	88 90	53.84	13.15	1.23		.45			
Whooping cough (011)	184	8 56	80.88	30.90	1.15	--------	.35		.23			
Mumps (016)	90	4.19	14.42	32 79	5.15	--------	1.06		----			
Chickenpox (015)	196	9.11	56.43	61.79	2.29	--------	.70		----			
Scarlet fever (010)	30	1.40	2.51	8.83	4.01	.97	.53		----			
Tuberculosis (all forms) (020–039)	67	3.12	--------	--------	2.29	2.92	4.05		3.85			
Reaction to smallpox vaccination (790)	62	2.88	19.44	15.13	1 72	.49	.53		----			
Noninfectious general diseases:												
Malignant neoplasm (100–169)	72	3.35	1.88	--------	--------	--------	--------	.27	1.58	6 20	10.82	22.33
Benign neoplasm and cysts of female genital organs (170–179, 657, 667)	50	2.33	--------	--------	--------	.49	2.08	4.78	5 04	2.19	2.40	.80
Other benign neoplasm (181–199)	49	2.28	.94		1.84		2.08	1.86	3.04		3 43	
Diabetes (210–219)	59	2.74	--------	--------	--------	--------	.52	.27	1.26	6.20	10.22	15.15
Diseases of thyroid and parathyroid glands (220–232)	66	3.07	--------	--------	1.15	1.56		6 05		4.09		.80

See footnotes at end of table.

960886—51——3

Table 2. Annual case rates [1] per 1,000 white persons of specific ages canvassed at monthly intervals in a sample of the Eastern Health District of Baltimore, 1938–43—Continued

Diagnoses with code numbers [3]	All ages		Age									
	Number of cases	Rate	Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
Diseases of nervous system:												
Neuritis and neuralgia (316, 337, 784)	163	7.58	-------	1.26	1.15	5.79		8.51		14.76		9 57
Nervousness (786)	230	10.70	1.88	3.15	2.29	7.31	11.46	12 75	11.66	20 43	14.42	12 76
Psychoneurosis (330)	127	5.91	-------	-------	1.15	2.44	4.69	9.56	8.82	10.22	9.62	2.39
Epilepsy and mental deficiency (335–336)	50	2 33	1.25	4.20		5.85	3.12	1 86	1.58	.73	.69	
Psychosis (320–329)	50	2 33	-------	.30		1.01		1.59	4.90		3 43	
Diseases of eye and annexa:												
Inflammation of conjunctiva and eyelid (347)	307	14.28	39.50	34.68	21.76	9.25	6.77	10.10	5.99	8.76	14.42	11.16
Other eye diseases (340–346, 348–349)	120	5.58	4.39	5.40		4.53		1.59	4.73	5.84	10.22	18 34
Diseases of ear:												
Earache (351)	235	10.93	45.14	35.31	12.60	8 77	7.29	7.17	4.41	2.55	1.20	1.39
Otitis media (350)	319	14 83	97.18	37.20	6.30	7.05		8.77	3.78	5 47	1.80	2.39
Diseases of heart and circulatory system:												
Rheumatic fever, rheumatic heart (200–204, 360, 365)	185	8.60	1.25	15.76	26.35	10.72	7.29	6 64	6.76		4 81	2.39
Other heart diseases (370, 380–389)	369	17.16	.63	1.26	1.15	.49	2.60	3.19	9.77	28.46	63 10	104.47
Hypertension, arteriosclerosis (290–295, 307, 390, 399, 400)	183	8.51	-------	1.89	3.44	.97	1.56	2.92	5.04	12.77	28.85	47.05
Varicose veins (410–414)	83	3.86	-------	-------	-------	.76		2.13	3.47	9.49	10 82	13.56
Hemorrhoids (416)	86	4.00	-------	-------	-------	.49	2.08	5.31	7.44		5.83	
Minor digestive diseases:												
Digestive disturbance (560–570)	1, 113	51.76	138 56	117.91	71.02	28.74	29 69	37.73	33 41	26 63	43.87	56 62
Diarrhea and enteritis (009, 530–539)	565	26.27	132.29	30.26	19.47	9.25	10.42	22.05	18.91	14.96	15.02	19.14
Other digestive diseases:												
Infected teeth and gums (510)	437	20.32	9.40	30.26	29.21	35.07	20.31	22.58	18 59	13.86	15.62	3 19
Diseases of mouth (514–517)	52	2.42	10 03	6 31	2 29	1.26		1.06	.95	1.46	1.80	2.39
Ulcer of stomach and duodenum (520–527)	61	2.84	-------	-------	-------	-------	1.04	5.05	6.30	5 47	3.00	-------
Appendicitis (540–549)	226	10.51	.63	10 09	14.32	22.89	20.83	14.61	6.30	4 38	3.43	
Hernia (550–559)	117	5.44	8.15	1.89	1.15	2 01		5.05	5.04	8.03	10.22	13.56
Cholecystitis and calculus (585–586)	116	5.39	-------	-------	-------	2.60		9.80		8.63		3.99K
Diseases of liver and gallducts (580–584, 587–589)	74	3.44	1.25	2.52	.57	.49	1.56	2.66	4.41	8.76	6.01	3 99
Other digestive (519, 529, 572–579, 590–599)	180	8.37	8.15	7.57	7.45	7 05		7.44	8.19	8.39	10.22	15.95
Diseases of kidney and urinary system:												
Nephritis (375, 600–607)	98	4.56	-------	.30		1.51		1.59	3 78	8.76	16.79	
Pyelitis (610)	60	2.79	2.15	3 90		3.02		2.39	2.52	2.55	2.40	
Other kidney diseases (612, 617)	51	2.37	-------	1.50		2 52		3.03		3.65	1.71	
Cystitis and calculus (619–621)	58	2.70	-------	.63	.57	2.01		2.13	3.78	6 20	3.77	
Other diseases of bladder and urethra (623–629)	16	.74	1 25	.60		.50		.72		.91		.80

Male genital diseases (nonvenereal): [4]												
Diseases of prostate (630–639)	31	2.92	------	------	------	.51		1.06	6.12		6.47	9.49
Female genital and breast diseases (nonvenereal) except tumors and cysts: [5]												
Diseases of ovaries, oviducts, and parametrium (650)	47	4.32	------	------	1.14	6.92	9.02	11.70	4 31	.74	------	------
Menstrual disorders (663–664)	439	40.35	------	------	39 91	64.23	54.11	46.28	55 35	65.38	22 45	------
Other female genital (652–656, 658–661, 666, 668–669)	137	12.59	1.27	1.36	------	7.91	18.04	26.60	16.61	17.83	6.73	2.75
Puerperal state: [5]												
Abortions and stillbirths (674–677, 694–695)	48	4.41	------	------	------	3.95	14.03	11.17	4.31	1.49	------	------
Live births (670–673)	324	29.78	------	------	------	23.72	107.21	77.13	28.91	.74	------	------
Complications of pregnancy, childbirth (680–689, 692–693, 696, 699)	167	15.35	------	------	------	13.83	47.09	40.43	16.61	2 23	------	------
Diseases of skin:												
Furuncle and carbuncle (700)	224	10.42	22.57	18.92	12 60	12.18	12.50	7.44	7.56	7.66	6.01	3.19
Cellulitis and paronychia (702, 704)	81	3.77	8.15	4.20		4.78		1.59	3.15	3.65	3.00	3.19
Impetigo (711)	107	4.98	30.09	25.22	7.45	.99	.52	.27	.32	.36	------	------
Other local skin infection (706)	125	5.81	6.27	6.31	3.44	3.90	3.65	5.48		7.30	9.62	7.97
Other skin conditions (713, 715–716, 719)	411	19.11	63.32	17.65	17.18	13.15	13.02	14.61	11.98	20.43	19 23	15 15
Diseases of bones, joints and organs of locomotion:												
Arthritis and chronic rheumatism (720–729, 783)	416	19.34	------	1.26	5.15	1.46	3.65	9 56	22.06	38.67	61.90	63.80
Lumbago and myalgia (740, 782)	186	8.65	1 25	2.52	4.01	4.38	6.25	8.77	12.29	16 05	13 82	10 37
Miscellaneous orthopedic conditions (730–739, 742–749)	152	7.07	.63	10.09	5.15	2 77		8.79		8.03	10.22	11.96
Other and ill-defined diseases:												
Headache (785)	601	27.95	1.25	15.76	20.05	16.07	14.58	28.96	42.86	59.47	36.06	7.97
Rash } (781, 789, 797–799)	87	4.05	16.93	5.67	3.44	2.44	3.13	2 39	2.84	2.19	3.00	3 99
Other and ill-defined } (781, 789, 797–799)	783	36.41	47.02	27.11	25 20	24.35	22 40	24.97	40.66	49.49		69.38
Number of full-time person-years of life observed (whole study)	21,505		1,595	1,586	1,746	2,053	1,920	3,764	3,173	2,741	1,664	1,254

[1] Rates per 1,000 in this table are computed with 2 decimal places for convenience in making further computations based on the rates even when the last digit is not significant. The total number of cases for each diagnosis is given in the first column and the populations for each age are at the bottom of the table in terms of full-time person-years of life.

[2] In this table each diagnosis includes all cases of the given disease whether they are the sole, primary, or contributory cause of the illness. Thus the sum of all cases in this table may be more than the total in table 1 which includes only sole or primary causes. For chronic diseases each disabling attack or episode (continuous period of disability) is counted as a separate case and cases not disabled at any time during the period of observation are counted as one case only. All ages includes a few of unknown age.

[3] Diagnosis code numbers as given in A Manual for Coding Causes of Illness, Public Health Service Miscellaneous Publication No 32, U. S. Government Printing Office, Washington, 1944. This table includes selected specific causes rather than every cause that appeared in table 6 of a preceding report (2). Some diagnoses with insufficient cases for an age curve are omitted but some are combined with other similar diagnoses.

[4] Rates based on male population only.

[5] Rates based on female population only. All other rates, including tumors and cysts of the female genital organs, are based on the total population of both sexes.

of the specific diagnoses is arthritis and chronic rheumatism, the case rate of which rises rapidly after 20 years of age to at least 65 years. The various skin diseases are generally high in the youngest ages and have a tendency to decline as age increases.

The common communicable diseases of childhood are not shown in the charts. The large frequencies of these diseases are so greatly confined to the ages under 15 years that narrower age groups are needed to show their age patterns. In a large city like Baltimore the frequencies are particularly high in the young ages. Thus, the highest rates for whooping cough and measles are in the ages under 5 years; rates for German measles, mumps, and scarlet fever are 2 to 4 times as high at 5–9 years as in the ages under 5. Chickenpox is also slightly higher at 5–9 than in the earlier ages. At 15–24 years, 4 of the 6 diseases have annual rates of less than 1 case per 1,000 persons observed; measles has 1.5 and German measles about 7. Even for a 5-year period one cannot say that the actual rates are expected average rates for these diseases which have wide epidemic fluctuations from year to year.

Summary

Data from a 5-year study of sickness in a sample of the Eastern Health District of Baltimore reveal the following relationships to the age of the individual.

In terms of cases, acute illnesses are important, particularly in the younger ages. Case rates for chronic diseases are overshadowed by the much larger numbers of acute cases (fig. 2).

In terms of days of disability (inability of the patient to be about his or her usual duties) per person under observation (sick and well), the chronic diseases are the overwhelming factor in the total sickness picture of days lost from work or other usual duties. This situation results from the long durations of disability per chronic disabling case. The durations of the few chronic cases in the younger ages are also long, but the numbers of such cases are few (fig. 3).

The heavy load of disability from all causes per person under observation (sick and well) in the older ages is largely due to change in the kind of diseases that attack older people, rather than to longer durations of diseases similar to those frequent among younger people.

Prevalence of illness from all causes shows about the same relative age picture as days of disability per person observed; this is necessarily true because prevalence represents a sample of the days of sickness related to the total persons observed (fig. 1).

The age selection of the different specific diagnoses varies so widely that any broad group as well as all illness combined represents a crude average of widely varying data for specific diagnoses (figs. 4, 5, 6, and 7).

REFERENCES

(1) Collins, Selwyn D.: Illness from heart and other cardiovascular-renal diseases in general morbidity surveys of families. Pub. Health Rep. **64:** 1439–1492 (1949). Reprint 2978.

(2) Collins, Selwyn D., Phillips, F. Ruth, and Oliver, Dorothy S.: Specific causes of illness found in monthly canvasses of families—Sample of the Eastern Health District of Baltimore, 1938–43. Pub. Health Rep. **65:** 1235–1264 (1950). Reprint 3046.

(3) Dorn, Harold F.: The incidence and future expectancy of mental disease. Pub. Health Rep. **53:** 1991–2004 (1938). Reprint 2001.

(4) Downes, Jean: Cause of illness among males and females. Milbank Mem. Fund Quart. **28:** 407–428 (1950).

(5) Jackson, Elizabeth H.: Morbidity among males and females at specific ages—Eastern Health District of Baltimore. Milbank Mem. Fund Quart. **28:** 429–448 (1950).

(6) New York State Department of Mental Hygiene: Annual Report for 1947. Legislative Document No. 80, 1947.

(7) Pollock, Horatio M., and Malzberg, Benjamin: Expectation of mental disease. Psychiatric Quart. **2:** 549–579 (1928).

(8) Tietze, Christopher: A note on the incidence of mental disease in the State of New York. Am. J. Psychiat. **100:** 402–405 (1943).

(9) Woolsey, Theodore D.: Age at onset of heart and other cardiovascular-renal diseases. Pub. Health Rep. **65:** 555-571 (1950). Reprint 3017.

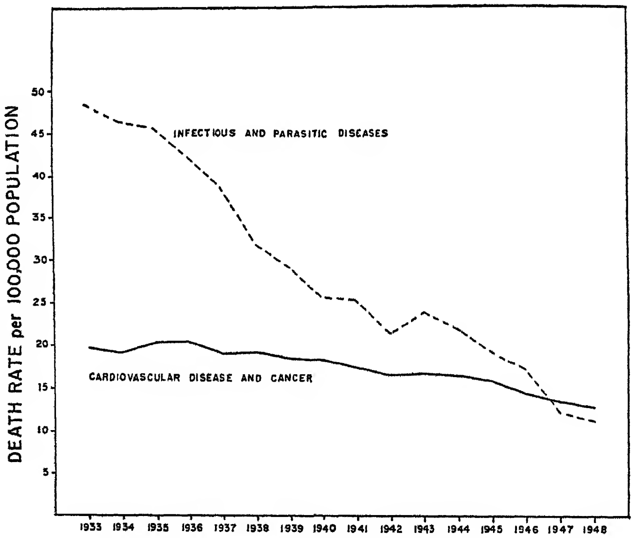
Changing Causes of Death in Childhood

By Harold A. Kahn*

The so-called degenerative conditions—cardiovascular disease and cancer—now cause more deaths among children of school age in the United States than all the infectious and parasitic diseases combined.

The array of infectious diseases frequently referred to as "childhood diseases" has in the past been associated with the young age group in various ways. They occurred more frequently than other diseases within the young group, and they were generally concentrated in this group rather than in other ages. In addition, these relationships were true for mortality as well as sickness measurements.

Within recent years, the long-term trend of decreased mortality from infectious diseases has resulted in a change in one of the above associations. The infectious diseases are no longer more frequent than other diseases as a cause of death among school-age children.



Source: National Office of Vital Statistics: Vital Statistics of U. S., 1933-1948,

Death rates from selected causes per 100,000 population, United States 1933–48, age 5–19.

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In 1948, cardiovascular disease and cancer deaths totaled 4,514 in the 5 to 19 age group, while the infectious and parasitic diseases accounted for 3,990 deaths in the same age group.

Table 1 and the accompanying graph show how this situation has developed during the past 15 years. Table 2 presents the more detailed components of each of these broad categories for 1948.

Table 1. *Number of deaths from selected causes and rates per 100,000 population, United States 1933–1948, age 5–19*

Year	Number of deaths		Rate per 100,000 population	
	Infectious and parasitic [1]	Cardiovascular and cancer [2]	Infectious and parasitic [1]	Cardiovascular and cancer [2]
1933	17,449	7,153	48.2	19.8
1934	16,767	6,958	46.4	19.3
1935	16,441	7,340	45.6	20.4
1936	15,141	7,368	42 2	20.5
1937	13,682	6,813	38.4	19.1
1938	11,328	6,881	32 0	19.5
1939	10,247	6,569	29.3	18.8
1940	8,903	6,465	25.7	18.6
1941	8,764	6,064	25.5	17.6
1942	7,375	5,664	21.7	16.6
1943	8,121	5,686	24 1	16.9
1944	7,397	5,512	22.3	16.6
1945	6,333	5,269	19.3	16.1
1946	5,860	4,818	17.6	14.5
1947	4,150	4,599	12.3	13.6
1948	3,990	4,514	11.5	13.0

[1] Section I of the International List of Causes of Death, Fourth and Fifth Revisions.
[2] Categories included are those which are most comparable to the following codes in the Sixth Revision of the International List of Diseases and Causes of Death; 330–334 (vascular lesions affecting C. N. S.), 400–468 (diseases of the circulatory system), and 140–205 (malignant neoplasms including neoplasms of lymphatic and hematopoietic tissues).

SOURCE: National Office of Vital Statistics: Vital Statistics of U. S., 1933-1948.

Table 2. *Number of deaths from selected causes, United States 1948, age 5–19*

Infectious and parasitic		Cardiovascular and cancer	
Tuberculosis (all forms)	1,688	Chronic rheumatic heart disease	985
Poliomyelitis and polioencephalitis	806	Other diseases of the heart	678
Measles	240	Acute rheumatic fever	390
Influenza	177	Vascular lesions affecting the central nervous system	327
Diphtheria	171	Other circulatory disease	103
Cerebrospinal meningitis (meningococcus)	151	Sub-total cardiovascular	2,483
Tetanus	127	Leukemia and aleukemia	789
Syphilis	65	Cancer of the central nervous system	348
Typhoid fever	41	Cancer of the digestive organs and peritoneum	149
Septicemia	40	Cancer of the urinary organs	81
Acute infectious encephalitis	39	Cancer of the respiratory system	78
Dysentery	34	Cancer of the uterus and other female genital organs	67
Scarlet fever	31	Cancer of the buccal cavity and pharynx	30
Typhus fever	30	Cancer of the male genital organs	26
Whooping cough	29	Cancer of the skin	14
All other	261	All other and unspecified cancer	449
Total	3,990	Subtotal cancer	2,031
		Total	4,514

SOURCE: National Office of Vital Statistics: Vital Statistics of U. S., 1947.

Coronary Occlusion With Myocardial Infarction in Young Males

—Report of Four Cases—

By Tracy Levy, M. D.*

Coronary artery disease can and does occur at any age. There is even a pathological condition that occurs in infants which produces a physiological condition similar to arteriosclerotic coronary artery disease. One must always keep in mind that, even though coronary artery disease is usually considered statistically an entity of the fifth, sixth, or seventh decades of life, substernal oppression, precordial pain, and angina of exertion must be investigated cardiologically in all age groups. In the literature, numerous reports are found of sudden deaths in the younger age groups of World War II personnel in which autopsy revealed advanced coronary sclerosis with occlusion of vessels with or without myocardial infarction.

Nichols (*1*) reports that the ratio percentage of coronary deaths to total deaths at the various ages increases to a maximum of 11.2 percent at age 60–64 years, and then consistently diminishes. In the higher age groups, death results in increasing numbers and proportions from noncoronary causes. The female death rate from coronary artery disease is consistently much less than that of males in all the race classes—in the aggregate, less than one-half. The rates are also much lower in the Negro and other races than in the white.

CASE REPORTS

Case 1. DPR No. 36 870. This 30-year-old white male was admitted to the Veterans Administration Hospital, Tuscaloosa, Ala., June 9, 1949, with the chief complaint of "severe pain in the chest." There was no history of previous or similar attack. The onset of the illness began rather acutely with dull pain, like indigestion, and was more or less limited to the epigastrium and substernal regions. The pain was dull and aching in character, as if something were pressing on the chest. He took some soda, but this gave him no relief. Soon afterwards he began to vomit. He was immediately taken to his private physician and was given an injection and some medicine for pain. He returned home and said that the pain was relieved to some extent by the medicine, but as the medicine "wore off" the pain returned, still dull and aching in the substernal and epigastric regions There was no history of shortness of breath He noted that on taking a deep breath he had severe pain in the upper epigastrium on the left side and across the left substernal region. He also noticed that he had pain on turning on to the left side.

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Since he failed to improve, he was admitted, first to the Druid City Hospital, Tuscaloosa, and then to this hospital. The pain persisted and was relieved only by narcotics.

Past history revealed that the patient, while in service, was hospitalized once for "frozen feet," once for "shrapnel wound of the right leg," and once for "kidney trouble."

Physical examination revealed that he was well developed and fairly well nourished. He appeared acutely ill and in some pain. There was no dyspnea or orthopnea. On palpation of the chest, tactile fremitus was transmitted normally, the percussion note was resonant throughout, and the bases moved freely on deep inspiration. On auscultation, there were many fine, crackling rales in both bases, laterally and posteriorly. Blood pressure was 90/60 mm. of mercury in both arms; pulse was 98; and the temperature was 99° F. The heart was within normal limits on palpation and percussion. The first sound was of poor muscular quality and somewhat muffled; rhythm was regular, and no murmurs were heard over any of the valvular areas. There were multiple small scars over the right shin, top of the right foot, dorsum of the left foot, left knee, and thigh as result of shrapnel wounds incurred in service. There was also a chronic eczematoid dermatitis on the feet. The remainder of the physical examination was within normal limits.

X-ray of the chest on admission revealed no significant pulmonary or cardiac pathology. Reexamination 4 days later was still negative. Complete blood count on admission was within normal limits except for elevated white cell count. Sedimentation rate was 18 mm. (Cutler) in 1 hour. Complete blood count on June 13 showed some diminution in the white cells and the sedimentation rate remained 18 mm. Repeated complete blood count on June 20 showed the white cell count to be elevated again, and the sedimentation rate was 25 mm. At the time of discharge the sedimentation rate was still slightly elevated, and there was still a slight leukocytosis. Urinalysis was normal. Cholesterol was 250 mg. percent. Feces was negative for ova and parasites. The admission electrocardiogram showed changes indicative of an acute anterior coronary occlusion with myocardial infarction. Repeated electrocardiograms indicated progressive healing of the myocardial lesion. Follow-up electrocardiograms exhibited the residuals of a healed anterior myocardium (fig. 1).

While in the hospital the patient was given heparin intramuscularly, 50 mg. every 6 hours for 8 doses and large doses of Dicumarol concomitantly. The initial dose of Dicumarol was 300 mg.; this was followed, in 24 hours, by 200 mg. The dose was then determined daily by the prothrombin activity. He was put on absolute bed rest. After 4 weeks' bed rest, during which time he was given passive exercises, he was started on gradually increasing active exercise. Dicumarol was then discontinued. He improved gradually and his strength slowly returned. There was no evidence of congestive failure. However, it was noted that moderate amounts of exercise caused angina and slight dyspnea.

Case 2. CSH No. 37 120. This 25-year-old white male was admitted to the same hospital on July 26, 1949, with the chief complaint of "pain in the chest." There was no history of indigestion, pain in the chest, or shortness of breath. The onset of the present illness began rather acutely about noon July 26, 1949, before lunch. The onset was with acute pain in the epigastrium, which lasted 5 or 10 minutes; the pain was sharp and continuous. There was nausea and cold sweat but no shortness of breath. When he sat down, he got some relief; the pain recurred when he walked. The pain was more or less evenly distributed to the right and left of the sternum in the midchest. The pain, as it spread into the chest, was dull and aching; there was no feeling, as if there were pressure in the

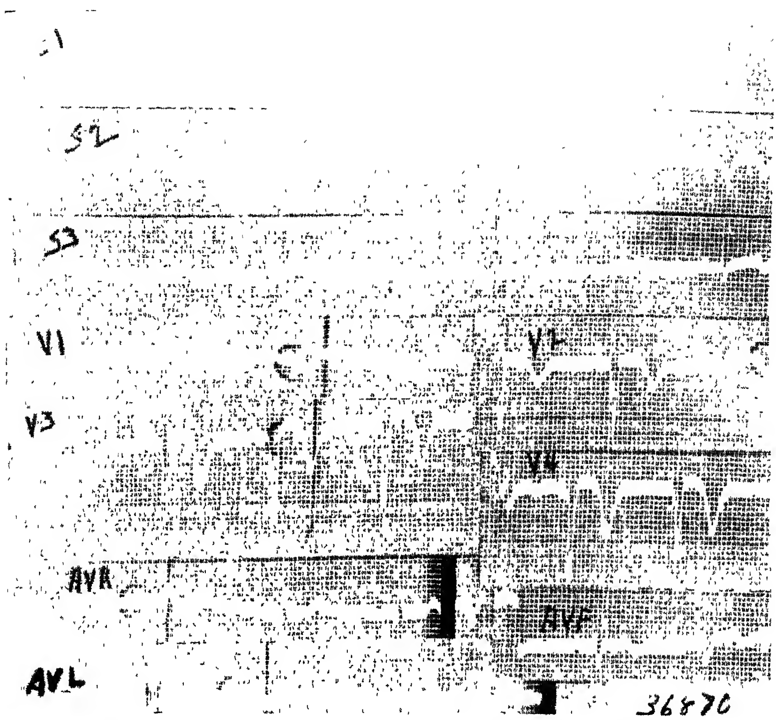

Figure 1. Electrocardiogram of case 1 showing typical changes in S 1 and S 2 and V leads.

chest. He called a physician and was given 100 mg. of Demerol. This relieved him markedly. The past history and review of systems were essentially noncontributory.

Physical examination on admission revealed that he was well developed and well nourished, and did not appear acutely ill. The head and neck were normal. Chest findings were normal except for evidence of a well-healed fracture of the middle of the left clavicle. Lungs were clear to palpation, percussion, and auscultation. Blood pressure was 120/80 mm. of mercury; pulse, 82 per minute. The heart did not appear enlarged and no thrills or murmurs were noted. The remainder of the physical examination was within normal limits.

Serology and urinalysis were normal. Complete blood count revealed a normal red blood cell count with a slight leukocytosis. Sedimentation rate (Cutler) was 12 mm. in 1 hour; bleeding and coagulation times were within normal limits. The leukocytosis gradually decreased, and the patient never showed any abnormal elevation of the sedimentation rate. Chest X-ray was negative. Cardiac fluoroscopy was within normal limits. The admission electrocardiogram revealed findings characteristic of an anterior coronary occlusion with myocardial infarction. Subsequent electrocardiograms indicated changes consistent with normal healing of the anterior myocardial infarct (fig. 2).

As soon as the diagnosis of coronary occlusion was established, he was placed on Heparin and Dicumarol concomitantly in the same manner as the previous case and maintained on Dicumarol until active exercise was started. The patient made an entirely uneventful recovery, was up and about by the end of August, and was discharged after 6 weeks hospitalization.

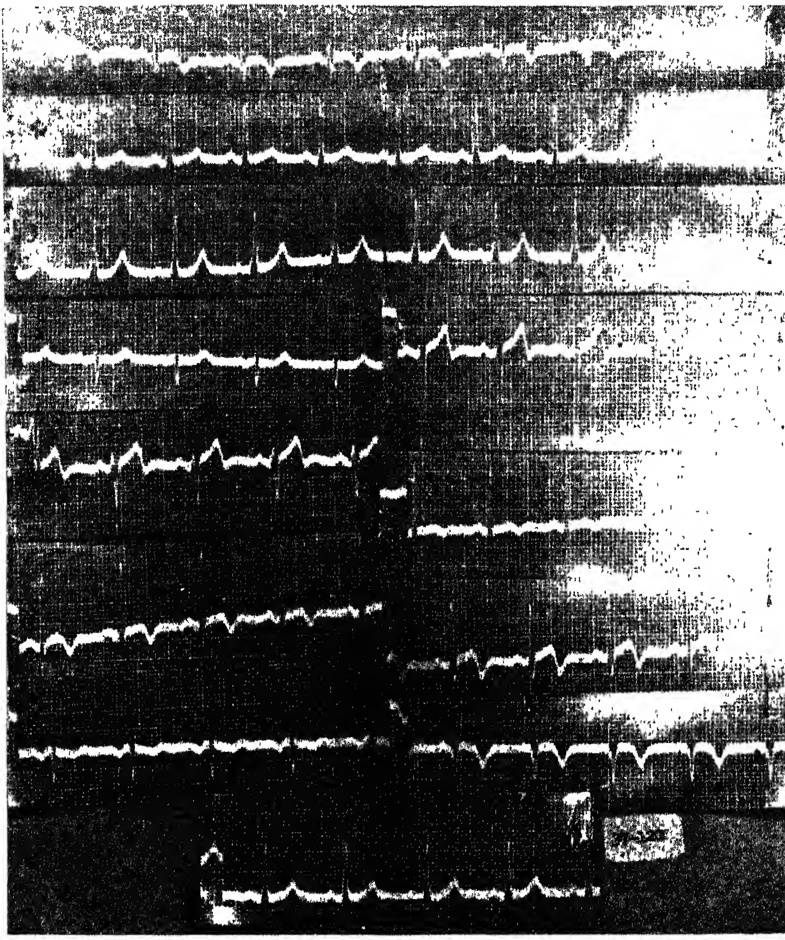

Figure 2. Electrocardiogram of case 2 showing the typical changes found in a recent anterior myocardial infarct.

Case 3. GA No. 41 015. This 33-year-old physician was admitted to Providence Hospital, Washington, D. C., July 10, 1950. His chief complaint was substernal oppression and a sensation of weight in this region. The onset was rather abrupt the morning of July 9, 1950. After some 20 minutes, the acute pain subsided and a "nagging" pain remained for some 24 hours. This "nagging" sensation was also present in both forearms for the same period of time.

Physical examination revealed that he was well developed and well nourished. The pulse was 82 per minute and the blood pressure, 120/85 mm. of mercury in both arms. A sinus arrhythmia was present. The electrocardiogram on admission was consistent with occlusion of the posterior coronary vessel with myocardial infarction. The sedimentation rate, white blood count, and differential count were within normal limits.

He was treated with anticoagulants (same dosage as cases 1 and 2) and bed rest for 4 weeks. His recovery was uneventful.

Case 4. WWA. This 32-year-old painter, white, seen in the out-patient clinic, complained of severe pain in the middle of his chest. He was short of breath and very anxious. There was no history of similar attacks. He had been painting on the outside of a building prior to the onset of the illness.

Physical examination revealed acute illness. He was pale and perspiring profusely. The pulse was 102 per minute and was weak and thready. The blood pressure was 90/60 mm. of mercury in both arms. The heart sounds were distant; the rhythm was regular. There were a few crackling rales in both lung bases posteriorly. The remainder of the physical examination was within normal limits. The electrocardiogram showed changes indicative of an acute anterior coronary occlusion and myocardial infarction.

He was treated with bed rest and the anticoagulant regime as previously described. He made an uneventful recovery.

Review of the Literature

Coronary artery disease in the younger adult age groups cannot be classified as rare. The table shows the number of cases occurring in the first four decades. The incidence increases thereafter.

Weinberg, Ochs, and Chesnicks (*3*) found 16 cases of myocardial infarction in the age group 25–35 years. All were males, 2 were Negroes.

French and Dock (*4*) at the Army Medical Museum reviewed 80 cases of coronary deaths in the age group 20–26. Seventy-three (91 percent) were overweight. Arteriosclerosis was the basic lesion in all instances.

Tullis (*5*) (quoting Connor and Holt), on reviewing 287 case reports of patients of all ages, noted that 1 percent had their initial attack before the age of 30. Masters and his associates (quoted by Tullis) found that 2 percent of 500 patients of all ages had their initial attack before the age of 30. Newman (*2*) collected 50 cases from the records of service men and women under 40 years of age where coronary occlusion was found at necropsy, or where the electrocardiogram supported the clinical diagnosis. The ages ranged from 20–35; 22 of the patients were in their twenties. He found all the patients were of good physical development; previous infection might have been of etiological importance in only a few; in more than half the cases there was no evidence of physical strain. He noted that sudden death took place in 33 out of 39 fatal cases. At necropsy, 37 out of the 39 fatal cases showed the usual degenerative atheromatous changes found in coronary disease of older subjects, and in 29 there was no thrombus. Richards (*6*) reported a case of coronary thrombosis with myocardial infarction in a 19-year-old white male. Severe coronary atheromatosis was present with medial cystic degeneration, marked general arteriosclerosis, and multiple renal infarcts.

Steigman and Glassner (*7*) found acute myocardial infarction in three young individuals. Poe (*8*) reported on 280 cases, 121 of which died of natural causes. In 7.4 percent, autopsy indicated that disease

of the coronary arteries was the cause of death. He found that evidence of fresh infarction is rare in young men dying of coronary artery disease. Nay (*9*) reported 6 cases occurring among soldiers; their ages were 25, 30, 30, 31, 37, and 38. None of the patients was known to have had hypertension previous to myocardial infarction. In none of the patients was there evidence of peripheral vascular disease. Glendy, Levine, and White (quoted by Nay), in a group of 3,376 cases of myocardial infarction, found 1.54 percent in individuals under 40 years of age. Nichols (*1*) found in the 25–29 age group that the ratio of coronary deaths to total deaths (in 1940) was 1.1 percent; in the 30–34-year-old group it was 2.2 percent.

Coronary occlusion by 10-year age groups from 0 to 40 years

Author	Age group			
	0–10 years	10–20 years	20–30 years	30–40 years
Tullis (quoting various authors)	-----	9	77	370
Nay	-----	1	4	-----
Poe	-----	-----	3	6
Stiegman and Glassner	-----	-----	1	2
Scott and Miller	3	-----		
Richards	-----	1	-----	-----
Newman	-----	-----	30	129
Nichols [1]	41	81	465	2,531

[1] Statistics from the entire United States in 1940 from Vital Statistics of the United States.

Minkowsk (*10*), following the work by W. Dock, studied the coronary arteries of 51 males and 25 females less than 1 day old who had died of birth trauma and/or asphyxia. He found that coronary intimal thickening may be expected to occur in a large number of newborn infants dying of various causes, and the mean difference in coronary intimal thickness between male and female is strongly suggestive if not actually significant. He also noted the role of acute infections appears to be an important one in producing intimal thickenings in older infants and children. Plotz (*11*) concluded that the most important disease of the coronary arteries is atheromata. Ninety to ninety-five percent of all cases of myocardial infarction result from changes in and around an atheromatous plaque. He found that the absence of one coronary artery is compatible with long life. In 26 patients, death could be related to this anomaly in only 6; in 4, there was myocardial infarction.

Narrowing of the coronary arteries is found rather frequently in patients with syphilitic aortitis (about 20 percent). However, myocardial infarction secondary to the stenosis occurred in only 7.5 percent of cases in which narrowing was present. Syphilitic and arteriosclerotic involvement of the same coronary artery is common.

There is little doubt that infection plays a role in the pathogenesis

of acceleration of arteriosclerotic changes. This may be primary or by extension from neighboring tissues. Tuberculosis rarely involves the coronary arteries. Rheumatic fever rarely causes significant occlusion of a main coronary artery in spite of the diffuse and necrotizing lesions that occur in the media. In polyarteritis nodosa, the coronary vessels are involved about 70 percent of the time. Secondary only to the renal arteries, the coronary vessels are the most frequently damaged by this disease. Thromboangiitis obliterans has also been found as a cause of coronary occlusion.

Scott and Miller (*12*) note that Hughes and Perry (1929) report coronary thrombosis in an infant 7 weeks of age; and Ramsey and Crumrine (1931) reported coronary thrombosis in an infant 4 months old. Scott and Miller reported a case in an 11-month-old infant. The lesions found were not unlike periarteritis nodosa, but the changes in the vessel walls and the thrombosis were more suggestive of thromboarteritis obliterans.

Stryker (*13*) states the lesions which may produce partial or complete occlusion include:

1. Medial calcification with fibroblastic proliferation of the intima.
2. Periarteritis nodosa.
3. Arteriosclerosis (atherosclerosis).
4. Syphilitic arteritis.
5. Embolism.
6. Congenital abnormalities.
7. Rheumatic arteritis.
8. Hypertension.

Stryker found that 15 cases, 8 girls and 7 boys, of medial calcification with fibroblastic proliferation of the intima have been reported in ages 1 day to 27 months. The youngest case of arteriosclerotic coronary disease reported occurred in a boy 10 years old.

It is not in the scope of this article to discuss diagnosis and treatment but to remind practicing physicians that coronary artery disease occurs at any age. Changes other than those due to arteriosclerosis may cause coronary occlusion. In infants and children, medial calcification with fibroblastic proliferation of the intima is the most frequent cause of coronary occlusion. Many congenital abnormalities have been found, and these are very frequently compatible with longevity, in fact, many unsuspected congential abnormalities are found only at autopsy. It is rather uncommon for these changes to cause or even contribute to the death of the individual.

Nichols (*1*) reported a gradual increase in the number of coronary deaths in the age group 60–64; after this there is a gradual decrease.

Overweight, infection, and physical strain have all been considered as precipitating factors in the young age group.

Summary

1. Four cases of coronary occlusion and myocardial infarction in males, aged 25, 30, 32, and 34, are presented.

2. A review of the literature on the subject of coronary artery disease in young adults is included.

REFERENCES

(*1*) Nichols, John B.: Mortality from coronary disease by age, sex, and race. Virginia Med. Monthly **74:** 225–226 (1947).

(*2*) Newman, M.: Coronary occlusion in young adults. Lancet **2:** 409–411 (1946).

(*3*) Weinberg, H B., Ochs, L., and Chesnick, R. B.: Myocardial infarction and/or fatal coronary disease in young soldiers. J. Iowa State Med. Soc. **37:** 56 (1947).

(*4*) French, A. J., and Dock, W.: Fatal coronary arteriosclerosis in young soldiers. J. A. M. A. **124:** 1233–1237 (1944).

(*5*) Tullis, John L.: Coronary thrombosis in youth. U. S. Naval Med. Bull. **45:** 334–338 (1945).

(*6*) Richard, G. A.: A case of coronary thrombosis with myocardial infarction in a nineteen-year-old white male. Ann. Int. Med. **24:** 908–911 (1949).

(*7*) Steigman, F., and Glassner, F.: Acute myocardial infarction in men below the age of 40. Military Surg. **99:** 177–181 (1946).

(*8*) Poe, William D.: Fatal coronary artery diseases in young men. Am. Heart J. **33:** 76–83 (1947).

(*9*) Nay, Richard M.: Acute myocardial infarction among young adults. J. Indiana Med. **39:** 335–338 (1949).

(*10*) Minkowsk, W. L.: The coronary arteries of infants. Am. J. Med. Sc. **214:** 623–629 (1947).

(*11*) Plotz, M.: Nonatheromatous lesions of the coronary arteries. Am. J. Med. Sc. **215:** 91–102 (1948).

(*12*) Scott, Edwin P., and Miller, A. J.: Coronary thrombosis. J. Pediatrics **28:** 478–480 (1949).

(*13*) Stryker, W. A.: Coronary occlusion disease in infants and in children. Am. J. Dis. Child. **71:** 280–300 (1946).

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended September 8, 1951

The total reported cases of poliomyelitis in the Nation increased from 1,762 last week to 1,871 for the current week. Since the seasonal low week, 14,311 total cases have been reported compared with 14,092 for the corresponding period in 1950. The cumulative total for the calendar year was 15,523 and for 1950, the corresponding total was 15,223.

Four of the nine geographic divisions reported increases in total poliomyelitis cases; the Middle Atlantic (from 218 to 260), slight increases in the East North Central (from 422 to 458), and the largest in the West South Central (from 157 to 245). In the Middle Atlantic Division, Pennsylvania reported most of the increase, from 54 cases last week to 89 for the current week. Ohio and Michigan also reported increases in the East North Central Division. In the West South Central Division, Louisiana reported an increase from 27 cases last week to 100 currently. No explanation has been received of the sudden increase in poliomyelitis reported in this State.

Decreases were reported in five geographic divisions, the most pronounced being in the Pacific, from 190 cases last week to 149 currently. Of the three States in this division, the largest decrease occurred in California, from 148 cases last week to 117 currently.

Malaria

Additional reports from States summarizing reported cases of malaria from January 1 through August show that a large majority are from military establishments. In Massachusetts 38 of a total of 39 cases were from military establishments. In California 16 cases were reported in civilians and 112 from the military. Two of the 16 civilian cases had probable sources of infection in California. Oklahoma reported 37 cases in civilians and 210 from military establishments. In South Carolina 19 civilian cases and 122 from the military have been reported. Only 1 of the 19 civilian cases was confirmed by blood smear and 9 were reported by 1 physician on clinical evidence only. In New York State, exclusive of New York City, 44 cases were reported in military personnel and 2 in civilians who had received

therapy for malaria in the past. In Arkansas 8 civilian cases, all Korean veterans, and 133 from military establishments were reported from January 1 to September 1, inclusive. Other States have reported smaller numbers of cases.

Epidemiological Report

Salmonellosis

Dr. D. H. Stevens, Maine Department of Health and Welfare, has reported nine cases of salmonellosis occurring between July 26 and August 7 in adjoining towns of Aroostook County. Six of seven cases in one town had consumed raw milk from a small dairy, and one of the six was the dairy owner's son. The seventh case was a relative of the dairy owner. One of the two cases in the other town had attended religious camp meetings with persons from the first town, but no clue as to a possible source was obtained in the second case. Laboratory examinations revealed *Salmonella paratyphi B* in the stools of six of the nine cases. Two other persons in the first town have been found to be harboring the same organism. Investigated cases have had "typhoidal" symptoms. Evidence, as yet unconfirmed, points toward a young relative of the dairy owner, who visited there late in July and is known to have handled milk. The boy remained a convalescent carrier following a paratyphoid B infection in 1948, but has refused to submit further specimens on religious grounds.

Dr. M. H. Merrill, California Department of Health, has reported two outbreaks of salmonella food infection. In 1 outbreak, 40 persons had a "pot luck" dinner in a private home, and of this group 30 are known to have become ill 12 to 48 hours afterward. Evidence pointed to home-made ice cream in which duck eggs and condensed milk were used in the mix, as the source of infection. The mixture stood at room temperature for 1½ hours before freezing. No specimens of ice cream were available for bacteriological examination, and other eggs from the same ducks showed no salmonella organisms. *Salmonella typhimurium* was isolated from most of the cases. In the second outbreak, 67 cases were reported among persons partaking of a smorgasbord dinner. Chopped liver is suspected of being the vehicle of infection, but none was available for examination. The incubation period varied from 5 to 71 hours. *Salmonella dublin* was isolated from patients.

Disease of Unknown Etiology

Dr. W. G. Beadenkopf, New York State Department of Health, has reported the occurrence of a disease in Putnam and Westchester Counties during July and August in which both gastrointestinal and respiratory symptoms were prominent. In each community it was estimated that 10 to 20 percent of the population was affected, with a somewhat higher rate in children. The onset was usually sudden

with fever, headache, sore throat, nausea, vomiting, and abdominal pain in about a third of the cases. On examination, pharyngeal injection, flushed face, and abdominal tenderness were frequently seen. Stiffness of the neck was noted in one-fourth of the cases. Infection by contact was suggested because of multiple cases in some families. Laboratory examinations so far have been inconclusive, but virus detection studies are incomplete.

Infectious Hepatitis

Dr. L. L. Parks, Florida State Board of Health, has reported seven cases of infectious hepatitis in Broward County. Predominate findings have been fever, enlarged liver and pneumonitis.

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Sept. 8, 1951	Sept 9, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	-------	1	-------	(1)	(1)	(1)	(1)	46	30	36
Diphtheria (055)	74	112	146	27th	452	657	1,155	2,460	3,785	5,765
Encephalitis, acute infectious (082)	24	37	34	(1)	(1)	(1)	(1)	711	631	446
Influenza (480–483)	308	369	369	30th	1,640	2,052	1,934	117,695	140,816	130,429
Measles (085)	873	506	543	35th	873	506	543	469,784	288,677	552,229
Meningitis, meningococcal (057.0)	40	36	40	37th	3,971	3,666	3,574	3,010	2,753	2,602
Pneumonia (490–493)	468	700	(2)	(1)	(1)	(1)	(1)	[3] 47,351	62,831	(2)
Poliomyelitis, acute (080)	1,871	1,743	1,726	11th	[4] 14,311	14,092	13,833	[4] 15,523	15,223	14,183
Rocky Mountain spotted fever (104)	5	11	17	(1)	(1)	(1)	(1)	278	394	467
Scarlet fever (050) [5]	227	291	355	32d	975	1,057	1,328	54,361	41,227	58,588
Smallpox (084)	-------	-------	-------	35th	-------	-------	1	11	26	50
Tularemia (059)	9	13	19	(1)	(1)	(1)	(1)	478	691	718
Typhoid and paratyphoid fever (040, 041) [6]	112	84	101	11th	[7] 1,628	1,905	2,111	[7] 2,063	2,415	2,596
Whooping cough (056)	952	1,890	1,798	39th	72,258	113,432	96,118	50,656	91,896	70,100

[1] Not computed.
[2] Data not available.
[3] Addition: Tennessee, week ended Sept. 1, 15 cases.
[4] Addition: Alabama, week ended Sept. 1, 20 cases.
[5] Including cases reported as streptococcal sore throat.
[6] Including cases reported as salmonellosis.
[7] Deduction: North Carolina, week ended Aug. 11, 1 case.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Sept. 8, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	74	24	308	874	40	468	1871
New England	1	3	2	102	1	18	55
Maine			2	35	1	9	6
New Hampshire				4		2	4
Vermont				12			1
Massachusetts	1	3		39			21
Rhode Island				6			3
Connecticut				6		7	20
Middle Atlantic	3	5		220	5	34	260
New York	1	3	(1)	134	2		128
New Jersey		2		29	1	10	43
Pennsylvania	2			57	2	24	89
East North Central	6	3	3	202	8	60	458
Ohio	5			28	4		102
Indiana		1	1	5		1	22
Illinois		1	1	65	4	14	108
Michigan	1	1	1	34		15	120
Wisconsin				70			106
West North Central	6	3		32	3	64	230
Minnesota	3			8	1	2	15
Iowa	2			3		1	31
Missouri		2		3	1		33
North Dakota				3		59	4
South Dakota				3		1	5
Nebraska				1			28
Kansas	1	1		11	1	1	84
South Atlantic	23	2	155	88	6	69	124
Delaware				1			
Maryland		1	5	37		19	13
District of Columbia				7		16	7
Virginia	1		123	17	2	25	14
West Virginia				3	1		21
North Carolina	7			3	1		16
South Carolina	7		5	4	1		2
Georgia	8	1	22	13	1	9	43
Florida				3			8
East South Central	14	3		27	6	41	155
Kentucky	3			19		1	27
Tennessee	2			5	5		63
Alabama	9	2		1		34	33
Mississippi		1		2	1	6	32
West South Central	7	2	68	57	6	120	245
Arkansas			37		1	17	28
Louisiana		1		2		15	100
Oklahoma			31	3		8	44
Texas	7	1		52	5	80	73
Mountain	1		62	51	1	17	195
Montana			7	9			6
Idaho				9			10
Wyoming				1			13
Colorado				13		8	92
New Mexico	1		1	6	1	4	6
Arizona			54	6		5	22
Utah				6			44
Nevada				1			2
Pacific	13	3	18	95	4	45	149
Washington			8	11		1	20
Oregon	6		5	17		5	12
California	7	3	5	67	4	39	117
Alaska							1
Hawaii			7	29		2	1

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Sept. 8, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	5	227		9	112	952	97
New England		18			3	81	
Maine		2				20	
New Hampshire		2					
Vermont		5				10	
Massachusetts		6			3	41	
Rhode Island		1					
Connecticut		2				10	
Middle Atlantic		26			10	137	8
New York		16			1	74	3
New Jersey		2			1	20	
Pennsylvania		8			8	43	5
East North Central		70			5	184	19
Ohio		26				52	
Indiana		3			1	25	[3] 12
Illinois		12			1	26	4
Michigan		24			1	26	3
Wisconsin		5			2	55	
West North Central		13			2	49	9
Minnesota					1	5	2
Iowa		2			1	10	3
Missouri		2				22	1
North Dakota		1				3	
South Dakota		2					
Nebraska							3
Kansas		6				9	
South Atlantic	5	36		3	17	69	12
Delaware		1					
Maryland	2	6			4	1	
District of Columbia		6				1	
Virginia	2	5		2	3	22	3
West Virginia		4			2		1
North Carolina	1	9			1	16	
South Carolina		1			4	3	3
Georgia		2			3	15	5
Florida		2		1		11	
East South Central		13			21	73	24
Kentucky		4			8	29	10
Tennessee		6			10	21	8
Alabama		2			3	22	4
Mississippi		1				1	2
West South Central		11		4	16	250	24
Arkansas		1		2	2	13	2
Louisiana		1			2		
Oklahoma		3		1	5	19	
Texas		6		1	7	218	22
Mountain		5		2	1	42	1
Montana						2	
Idaho						4	
Wyoming				2	1	2	
Colorado		4				20	
New Mexico						3	1
Arizona						8	
Utah		1				3	
Nevada							
Pacific		35			37	67	
Washington		3			2	4	
Oregon		6			1		
California		26			34	63	
Alaska							
Hawaii							

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.
[3] Report for 2 weeks.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Aug. 25, 1951

Disease	Total	New-found-land	Prince Ed-ward Island	Nova Scotia	New Bruns-wick	Que-bec	On-tario	Mani-toba	Sas-katch-ewan	Al-berta	Brit-ish Co-lum-bia
Brucellosis	3					1	2				
Chickenpox	200	2		3		51	71	8	5	34	26
Diphtheria	6					5	1				
Dysentery, bacillary	6							1			5
Encephalitis, infectious	1								1		
German measles	58					11	9		8	17	13
Influenza	10			5			3	1	1		
Measles	268	4		28	5	70	24	15	9	75	38
Meningitis, meningococcal	5					3	2				
Mumps	118	2				26	50	6	15	9	10
Poliomyelitis	195			22	3	21	124	4	10	5	6
Scarlet fever	104					36	14	21	15	3	15
Tuberculosis (all forms)	215	3		6	9	77	25	40	10	17	28
Typhoid and paratyphoid fever	17					9	4			1	3
Venereal diseases:											
Gonorrhea	295	6		2	10	56	65	38	32	31	55
Syphilis	55			4	1	22	9	3	3	7	6
Primary	3					2					1
Secondary	5			2			1	1		1	
Other	47			2	1	20	8	2	3	6	5
Other forms	1										1
Whooping cough	162			13		66	27	6	11	24	15

FINLAND

Reported Cases of Certain Diseases—July 1951

Disease	Cases	Disease	Cases
Diphtheria	76	Typhoid fever	7
Dysentery	13	Venereal diseases:	
Meningitis, meningococcal	7	Gonorrhea	554
Paratyphoid fever	117	Syphilis	11
Poliomyelitis	8	Other forms	2
Scarlet fever	991		

NEW ZEALAND

Reported Cases of Certain Diseases and Deaths—4 Weeks Ended July 28, 1951

Disease	Cases	Deaths	Disease	Cases	Deaths
Brucellosis	5		Influenza	2	2
Diphtheria	8		Meningitis, meningococcal	15	2
Dysentery:			Poliomyelitis	2	
Amebic	3		Scarlet fever	66	
Bacillary	6		Tetanus	3	
Encephalitis, infectious	4	1	Trachoma	2	
Erysipelas	8		Tuberculosis (all forms)	151	42
Food poisoning	64		Typhoid fever	8	

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Cholera

Burma. A total of five cases of cholera and three deaths was reported in Tavoy for August 19–25. For the previous period, August 12–18, 7 deaths were reported with 12 cases.

Plague

Brazil. For the period June 1–30, a total of two cases of plague was reported. The total included one case in Bodoco, and one case in Exu, Pernambuco State. For the period, July 1–31, one case of plague was reported from Bodoco.

Smallpox

French Equatorial Africa. For the period, August 11–20, 21 cases and 3 deaths from smallpox were reported in Tchad.

French West Africa. For the period, August 11–20, a total of 58 cases and 3 deaths from smallpox was reported. The total included nine cases and one death reported previously from Dahomey. The total also includes 21 cases and no deaths from the Ivory Coast, and 15 cases and 2 deaths from Soudan.

Indochina. For August 19–25, cases of smallpox were reported in Viet Nam as follows: Haiphong, 5; Saigon, 1; and Hanoi, 1.

Typhus Fever

Algeria. For August 11–20, one case of typhus fever was reported.

Chile. For August 19–25, three cases were reported in Santiago.

Iran. For the period, August 26–September 1, one case of typhus fever was reported.

Iraq. For the period, August 26–September 1, three cases of typhus fever were reported.

Mexico. For the period, July 15–21, one case of typhus fever was reported in Camargo. For the period July 15–28, a total of five cases, and for the period, July 29 to August 11, a total of eight cases of typhus fever were reported from Mexico, D. F.

Turkey. For the period, August 26–September 1, one case of typhus fever was reported.

Yellow Fever

Costa Rica. A total of five deaths from jungle yellow fever for August 16 was reported in San Miguel Zone, Sarapiqui, and a total of three deaths from the same cause was reported for the period August 26 to September 1 in Los Angeles Zone, Sarapiqui.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price per year—$4.75, domestic; $6.25, foreign.

Public Health Reports

VOLUME 66 **OCTOBER 5, 1951** NUMBER 40

TUBERCULOSIS CONTROL ISSUE NO. 68

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PUBLIC HEALTH SERVICE

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This is the sixty-eighth of a series of special issues of PUBLIC HEALTH REPORTS devoted exclusively to tuberculosis control. The special issues began March 1, 1946, and appear the first week of each month. The articles are reprinted as extracts. Effective with the July 5, 1946 issue, these extracts may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents a single copy. Subscriptions are obtainable at $1.00 per year, $1.25 foreign.

Public Health Reports

Vol. 66 • OCTOBER 5, 1951 • *No. 40*

Body Mechanisms in Progressive Tuberculosis

By Howard M. Payne, M.D.*

The course of pulmonary tuberculosis is influenced by the interaction of many complex factors. The number and virulence of tubercle bacilli present in the lesion is balanced against the host's constitutional ability to limit their growth, resist tissue destruction, and isolate with fibrosis the areas of infection.

The philosophy of management in tuberculosis may be stated simply. One must close cavitary defects and limit or retard the growth of tubercle bacilli. The constitutional resistance of the host must then continue to hold tubercle bacilli in check and maintain barriers against their growth.

Although the exact nature of the body mechanisms which contribute to resistance against tuberculosis is to a large extent speculative, the existence of such factors is, however, demonstrable in animals, as in the work of Lurie with rabbits (*1*). Immune or resistant mechanisms in the human are somewhat more difficult to demonstrate except by analogy. It is possible, however, to formulate from isolated observations a concept of the physiologic and chemical factors which to some extent contribute to host resistance against the spread of tuberculosis or which, when deficient, permit progression of tuberculosis. It must be recognized that complex emotional influences contribute to and precipitate the physiologic mechanisms which produce favorable conditions for progressive tuberculosis.

The controlled study of streptomycin therapy has demonstrated that constitutional factors significantly affect the prognosis in pulmonary tuberculosis. The table below is suggested by a theory of Long and Ferebee which postulates that a given tuberculous population may show three major tendencies caused by the influence upon the prognosis of constitutional and other nonbacterial factors (*2*, *3*). One tendency is toward progressive disease and death. The other tendency is toward arrest and cure. In the third, a part of the population will not have either a marked tendency to progression or to

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recovery. This analysis indicates that the group which tends toward recovery and the group which is doubtful in prognosis are most helped by the administration of streptomycin. The group experiencing the least favorable tendency to recover shows only a prolongation of life and temporary improvement.

The influence of constitutional factors upon the response to streptomycin treatment

Predisposition of patients to recovery	Changes in X-ray lesions and symptoms	
	In streptomycin-treated patients	In patients treated without streptomycin
Favorable	More rapid and striking	Improvement occurs more slowly.
Doubtful	An increased number of favorable changes—some unfavorable.	Improvement not as frequent and unfavorable changes more frequent.
Unfavorable	Progression of disease delayed. Deaths occur later in the observation period. Symptoms initially improve.	Rapid progression of lung lesions and death early in the period of observation. Slight if any improvement in symptoms.

A current study of patients treated in the Howard University Chronic Chest Disease Service confirms this theory. The dosage of streptomycin bears no direct relation to the recovery of tuberculous patients. Partial analysis of hospital data indicates that groups treated with streptomycin experience a prognosis comparable to that of untreated groups despite the fact that patients with unfavorable outcomes received more drug for longer periods. If observation is sufficiently prolonged, it is seen that streptomycin administration has prolonged life but gives no lasting improvement in the prognosis.

Medlar and others have stressed the importance of apical foci in the pathogenesis of progressive pulmonary tuberculosis (*4–7*). Pinner called these "apical nodular foci" and believed that there was much evidence to support the theory of Loeschke that these lesions precede, in many instances, the development of subapical lesions with which we are clinically familiar (*8*).

Medlar has demonstrated that many of these apical nodular foci, though encapsulated and sometimes even partially calcified, contain caseous matter and virulent bacilli.

These lesions when observed on chest X-rays have been loosely called inactive apical nodules, apical scars, or pleural caps. The process of breakdown of these inactive lesions can be observed on serial films with sufficient frequency to justify the pathologists' earlier contention that the apical tuberculous nidus may frequently be the source of progressive pulmonary tuberculosis.

This is confirmed by the fact that many of our tuberculous patients are now in the ages past 50. These patients, for the most part, will have experienced contact and inoculation of the lung with tubercle bacilli many years before becoming ill of progressive tuberculosis.

We may assume from observation of these patients that host-

resistance remained adequate to the suppression of bacillary growth for varying periods up to many years. Progressive tuberculosis may develop if physiologic deficiencies occur. The severity of progression is probably related to the duration and degree of disturbed metabolism.

The physiologic changes which precede or facilitate breakdown of these lesions, although often smaller in degree, must be comparable in kind to those which operate to make clinical tuberculosis acutely progressive.

Exogenous infection may also, within a short period of time, cause progressive pulmonary tuberculosis. The physiologic factors which lower resistance, if operative at the time of such infections, facilitate immediate extension of disease into the acute phase.

Whether the first episode of progressive disease is the immediate or remote consequence of exogenous infection, we are concerned largely with the type of pulmonary tuberculosis characterized by the exudation of plasma containing cells, fibrin, and bacilli into the organ interstices and resulting eventually in massive death of cells, caseation, softening, and cavitation. Fresh fibrosis in acutely progressive tuberculosis does not develop as rapidly or in sufficient amounts to form an efficient protective barrier against continued tissue injury. It must be realized that all exudative tuberculosis is potentially progressive regardless of extent and that as a general rule progression is acute and healing slow.

Physiology of Constitutional Resistance

The early tuberculosis workers recognized the existence of acutely progressive forms of tuberculosis and attributed their occurrences to constitutional weakness, inherited predisposition, or to habit.

The existence of constitutional resistance is unquestioned. The solution of the clinical problems of tuberculosis, however, depends upon the recognition of the exact physiologic processes which when enhanced or impaired influence the characteristics of tuberculous disease once it develops.

Lurie has conclusively demonstrated that constitutional resistance and susceptibility can be inbred in strains of rabbits (*1*). From observation of infected rabbits, he associates the hypertrophy of the adrenals with resistance to tuberculosis. He finds that cortisone suppresses allergic manifestations, increases growth of bacilli within phagocytes, and diminishes antibody formation. The withdrawal of cortisone caused death due to massive tuberculous pneumonia.

Other workers have concluded that cortisone has a definitely harmful effect on the course of experimental tuberculosis (*9*). Our own observation has been that ACTH used in two patients produced massive pneumonic lesions in one and led to the resolution of productive tissue and development of empyema necessitatus and multiple

chest wall abscesses in another. A third arrested patient treated for two periods of 3 weeks with ACTH, 25 mg. every 6 hours, showed no spread and was able to survive two severe bouts of delirium tremens apparently because of the drug.

Selye (*10*) has interpreted his observations upon experimental animals subjected to nervous strain, trauma, fatigue, infections, intoxications, heat, or cold as indicative of the fact that there is a general response superimposed upon the specific effects of "stressor agents." He postulates a "general adaptation syndrome" composed of three stages:

1. *The Alarm Reaction.* The development of adreno-cortical enlargement, thymo-lymphatic involution, and symptoms of shock.

2. *Stage of Resistance.* The development of adaptive changes in which the effects of stress are balanced.

3. *Stage of Exhaustion.* The loss of balance or adaptation to stress.

He further believes that derangements of this syndrome may produce organ deficiencies in the nervous system, kidneys, and liver, due to imbalance in the anterior pituitary-adreno-cortical-organ system. A number of complex hormones must act in delicate balance to maintain the stage of resistance. ACTH induces the production of adrenal cortex hormones which exert an inhibitory effect upon diseased organs, enhancing catabolic changes, diminishing granulomatous changes, and inhibiting allergic response. Conversely, the other anterior pituitary hormone STH in concert with adrenal hormones of the desoxy-cortico-steriod type, stimulates diseased organs to anabolic activity, granuloma formation, allergic sensitivity, and connective tissue proliferation.

It seems probable that abnormalities in the STH-mineralo-cortoid balance with ACTH-gluco-cortoid system may diminish the protective response of the lung to infection with tubercle bacilli. Genotypic or acquired abnormalities of metabolism may cause such imbalance. Since the anterior pituitary hormones are complex proteins, it may be that amino-acid deficiencies or protein depletion prevents their adequate production by the gland.

Kahn (*11*) recently postulated that the catabolic changes which are constantly taking place in the body are responsible for cellular disintegration. The release of cellular lipid substances evokes a typical pattern of antibody responses. These may be demonstrated by a complex agglutination test similar to the Kahn test used in syphilis. Kahn shows characteristic patterns of agglutination for yaws, syphilis, tuberculosis, and malaria. In addition, agglutination patterns were demonstrated for normal persons residing in Michigan and for Navaho Indians. It is striking that the agglutination patterns for apparently well Navaho Indians and those of tuberculous patients are similar. It may be postulated that under certain condi-

tions of infection, persons experiencing a negative metabolic balance and cellular disintegration may be more likely to develop progressive tuberculosis. Confirmation of Kahn's thesis may add to our armament a valuable tool for the evaluation of resistance to tuberculosis.

Cannon states that protein or essential amino-acid deficiencies lead to metabolic deterioration, loss of body weight, nitrogen deficiency, loss of appetite, and a feeling of malaise (*12*).

A balanced adequate amino-acid intake is of primary importance in growth, in severe infections, and in the maintenance of resistance through the protein role in the fabrication of specific antibodies. Amino-acid depletion impairs the immunologic functions of the reticulo-endothelial system and blood forming tissues, and the production of enzymes. Phagocytic blood cells diminish in the presence of protein depletion.

Damaged organs and depleted organs draw first from the available stocks of body protein. These organs may appropriate a large share of available protein. When this occurs the liver and anterior pituitary, important as they are to maintenance of resistance, may fail to obtain the protein essential to their function.

A "protein pool" exists in the muscles, liver, tissue cells in general, the hemoglobin, and the plasma protein (*13*). A labile transitional fraction of the protein in liver, cells, and muscles may enter the plasma store in answer to an increase in protein requirements. The globin of hemoglobin is favored in protein synthesis and apparently exerts priorities upon the transitional protein. It is lost only where protein depletion becomes severe. Anemia does occur before marked changes in the plasma protein are present.

Prime indicators of protein deficiency are:

Loss of body weight.
Hypochromic anemia.
Leucopenia.
Loss of muscular strength.
Slow wound healing.
Deficient hormone, antibody, and enzyme synthesis.
Lymphoid depletion.

Smit, medical director of Springfield Hospital, Durban, Union of South Africa, reports (*14*) autopsy observations which show that massive caseous lesions of lungs and lymph nodes, indicative of poor resistance, occur with greatest frequency in the younger age groups of Bantu laborers and that lesions in older Bantus tended to be similar to those he found at autopsy in more resistant groups. He also reports that parenchymatous liver damage is almost universally present on biopsy and autopsy in the poorly resistant Bantu and rarely in the more resistant racial and cultural groups.

Recent work by Hackney on our service indicates that decreases

of the albumen-globulin ratio, a positive cephalin-cholesterol flocculation test, and the degeneration of liver cord cells are frequent in a group of adult Negro patients hospitalized for tuberculosis (*15*).

Gillem precipitated from the plasma of progressive tuberculous patients abnormal amounts of a globulin resembling in many respects the globulins reported present in progressive tuberculosis by electroporetic analysis by Siebert (*16*).

The available evidence leads to a hypothesis concerning the basic physiologic mechanisms which influence resistance to progressive tuberculosis.

1. Present theory indicates that a balance between complex protein molecules or hormones produced by the anterior pituitary gland stimulates a defense reaction against infection or stress. One of these hormones (STH) is particularly responsible for productive or fibrotic changes, allergic response, and phagocytic activity.

2. The balance between catabolic and anabolic activities is disturbed in tuberculosis. Conditions, such as malnutrition, growth, pregnancy, chronic infection, diabetes, alcoholism, intestinal disease or extreme physical exertion, place the various depleted organ systems in competition for the essential protein materials required for healing the diseased lung.

3. Imbalance in protein metabolism, whether inborn or acquired, may be reponsible for lowered resistance to progressive tuberculosis through insufficiencies in the essential amino acids needed to build hormones, antibodies, and phagocytes and to replace destroyed body cells.

4. Deficient constitutional resistance to progressive tuberculosis may logically be explained by the existence of protein depletion as a predisposing factor or as an influence occurring in consequence of the disease.

Clinical Management of Progressive Tuberculosis

The considerations discussed above should lead to practical conclusions useful in treatment.

First of all, the breakdown of preclinical apical nodular tuberculosis first seen in clinics or surveys may be prevented to some extent if these patients are given good medical supervision.

Diabetes, pregnancy, nephritis, physical exhaustion, occupational hazards, alcoholism, or psychic trauma may contribute to a dangerous state of protein depletion. It therefore seems reasonable to propose that patients discovered in chest clinics or surveys receive careful clinical interviews, physical examinations, and routine laboratory checks to determine the existence of such conditions. The patient should be educated about diet, personal hygiene, adequate rest, and

the importance of regular chest X-rays even after the lesion has been determined inactive. Social work should be intelligently employed to relieve emotional stress and to help with personal and family problems before these patients break down. The early placement of these patients in safe vocations is often neglected as a preventive procedure.

The physician must be guided by a broad knowledge of the race-age-sex-occupation-specific risks of breakdown in his teaching of patients and recommendations for chest X-ray follow-up.

Patients with apical scars or apical nodular tuberculous infiltration may not develop clinical tuberculosis for years, if they ever do. Specific treatment for tuberculosis is, therefore, not needed. Preventive therapy must be based on treatment of metabolic disorders, correction of deranged physiology, especially protein depletion, and a generally competent medical survey of the whole patient.

The clinically ill patient with tuberculosis requires a more active program of treatment.

Rest Therapy

The prescription of rest should be administered as conscientiously as that of antibiotics and should be accompanied by active efforts to relieve stress and muscular tension. The technique of Jacobson for the teaching of muscular relaxation may be employed by physicians and nurses in teaching rest. In hospitals, a rest-therapy-team composed of a physician, social worker, an occupational therapist, and nurse should actively schedule intensive teaching for each patient until he has learned the techniques of actual rest and relaxation.

Smit reports that patients who are taught to rest lying on the affected side with an 18-inch elevation of the foot of the bed showed results comparable to those obtained with pneumoperitoneum (*14*). This technique is worth further study.

Antibiotic Therapy

The employment of streptomycin and PAS in combination is essential. Fixed periods of administration should be avoided. The duration of streptomycin treatment cannot be predetermined for patients with progressive tuberculosis. Two grams of streptomycin or dihydrostreptomycin every third day with 12 grams of PAS daily may be required for 4 to 6 months. This treatment should be continued until body weight, sedimentation rate, plasma protein levels, and the percentage of hemoglobin return to normal levels. The conversion of the sputum to negative should be regarded as showing bacteriologic recovery. Evidence of physiologic recovery is important to an enduring cure.

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Protein Therapy

Loss of body weight, hypochromic anemia, loss of appetite and muscular strength are indicative of protein depletion. Our own studies indicate that evidences of hepatic insufficiency and deficient protein metabolism are more common than realized among patients experiencing progressive pulmonary tuberculosis (*15*). These evidences are a positive cephalin-cholesterol flocculation test, reversal or decrease in the ratio of plasma albumen to globulin, a microcytic hypochromic anemia, and parynchymatous degenerative changes in the hepatic cells.

On this basis, we propose that balanced amino-acid digests be used as medicinal agents in sufficient amount to supply an additional 1.5 gram of protein per kilo. These are given after meals as soups, or in suitable media. The protein digest which we are employing is a 65-percent mixture of yeast, skim milk, pancreas, beef heart, yeast and liver proteins supplied by Armour Laboratories. A daily dose of 180 grams provides approximately 110 grams of protein supplement. This medication should be continued until evidence of protein repletion and stable disease is obtained. An adequate basal diet of 2,800 to 3,000 calories containing approximately 90 grams of protein is given. This prevents consumption of the amino-acid supplement to supply caloric needs.

As aids to the protein metabolism, we employ B vitamin, crude liver extract, and ascorbic acid along with the protein digest. The use of methionine, 5 grams, or choline, 5 grams, daily has seemed to be of value in this regimen.

Collapse Therapy

The full employment of pneumothorax, pneumoperitoneum, and surgical collapse along with all other measures is, of course, necessary. The institution of collapse therapy along with measures directed toward general physical restitution and control of infection is important.

Graduated Exercise, Rehabilitation, and Occupational Therapy

The patient who recovers from the febrile catabolic phase of tuberculosis must, as soon as feasible, be returned to physical activity in graduated steps. Studies in surgical convalescence during World War II indicated that the maintenance of nitrogen balance and the healing of damaged tissues was facilitated by the resumption of physical activity. This procedure must be intelligently individualized. Occupational therapy is an important factor in treatment by graduated activity since the physical efforts involved may be supervised and graded. During this period the patient should be observed carefully.

Trends in weight, hemoglobin, appetite, and sedimentation rate should be considered along with the chest film in determining the permissible activity.

Education in a proper dietary regimen is important. Hospital dietitians should teach patients and their families the essentials of a proper basic diet.

The patient needs close supervision and direction, until he makes a proper vocational adjustment, if his recovery from progesssive disease is to be maintained. Persons ill of progressive tuberculosis are less able to feel secure in a chance acquired job after recovery. The bad influence of unsuitable employment upon tuberculous patients is well established but not generally anticipated by physicians in planning management.

Conclusions

1. Constitutional resistance plays a large part in the pathogenesis, treatment of, and recovery from, progressive tuberculosis.

2. Physiologic and metabolic derangements which precede and accompany the development of progressive tuberculosis play a role more potent than that of the bacterial population which cannot be permanently controlled unless the host's resistance improves.

3. Protein depletion diminishes the constitutional resistance to tuberculous progression. The amounts of protein required in the course of progressive pulmonary tuberculosis are probably much in excess of those customarily supplied in the diet.

4. Antibiotics, collapse therapy, rest, graduated exercise, social services, and proper job placement after recovery must be skillfully employed in the therapy of progressive tuberculosis with proper regard to the indications of protein repletion or depletion.

5. Active medical management of patients who show apical nodular tuberculosis may prevent the development of progressive tuberculosis in subsequent years. The early recognition and treatment of metabolic abnormalities, alcoholism, gastric or intestinal disorders, malnutrition, and other conditions which contribute to protein depletion may prevent the progression of tuberculous lesions.

REFERENCES

(*1*) Lurie, Max B., et al: Constitutional factors in resistance to infection. To be published in Transactions of the 47th annual meeting of the National Tuberculosis Association, 1951.

(*2*) Long, Esmond R., and Ferebee, Shirley H.: A controlled investigation of streptomycin treatment in pulmonary tuberculosis. Pub. Health Rep. **65**: 1421–1451 (1950).

(*3*) Payne, Howard M., and Hackney, Robert L.: A consideration of the clinical use of antimicrobial agents in pulmonary tuberculosis. J. Nat. Med. Assoc. (in press).

(*4*) Medlar, E. M.: Apical scars, their etiological relationship to tuberculous infection. Am. Rev. Tuberc. **55**: 511–516 (1947).

(5) Medlar, E. M.: Pathogenesis of minimal tuberculosis. Am. Rev. Tuberc. 58: 583-611 (1948).
(6) Aschoff, L.: Über den Phthisischen Renfekt der Lungen. Klin. Wchnschr. 1: 50 (1929).
(7) Jaffe, R. H.: Pathogenesis of post-primary tuberculosis. Arch. Path. 18: 712 (1934).
(8) Pinner, Max: Tuberculosis in the Adult. Springfield, Charles C. Thomas, 1945, p. 179.
(9) Cummings, M. M., and Hudgins, Paul C.: The influence of cortisone upon experimental tuberculosis. To be published in Transactions of the 47th annual meeting of the National Tuberculosis Association, 1951.
(10) Selye, Hans: Stress. Acta Endocrinologica Inc. Medical Publishers, Montreal, 1950.
(11) Kahn, Ruben L.: An Introduction to Universal Serological Reaction in Health and Disease. New York, Commonwealth Fund, 1950.
(12) Cannon, P. R.: Protein and amino-acid deficiencies. American Lectures on Pathology No. 27, Springfield, Charles C. Thomas, 1948.
(13) Whipple, G. H.: Hemoglobin, plasma protein and cell protein. American Lecture Series No. 12, Springfield, Charles C. Thomas, 1948.
(14) Smit, Pieter: Personal communication (medical director, Springfield Hospital, Durban, Union of South Africa.
(15) Hackney, Robert L., et al.: The study of the liver in pulmonary tuberculosis. Unpublished.
(16) Gillem, Norbert P.: The occurrence of abnormal plasma globulins on precipitation with 13½ percent sodium sulfite. Unpublished.

Nursing in Tuberculosis Hospitals

By Martha Ball Naylor, R.N., M.P.H.*

Skilled nursing care is one of the services essential to the recovery of the patient with tuberculosis. Yet there is not enough good care available to him.

This is a situation all too familiar to health leaders. It constitutes a difficult problem which will continue, despite declining death rates, unless we now face it squarely, determine the reasons for it, and do something about it.

Many beds in hospitals for the care of tuberculous patients are closed, although tuberculosis is still seventh on the list of causes of death in the United States and new hospitals are being built in many areas. The reasons behind this paradox are indicated by information collected in connection with the Index of Hospitals with Tuberculosis Beds, (1) covering about 600 hospitals with a rated bed capacity of 88,000 beds. Ninety-three of these hospitals, with a total of 24,300 beds, reported that 5,200, or more than 20 percent of their beds were not in use. Three hundred and eighty closed beds were due to lack of physicians; 1,500 (or about 30 percent of vacant beds) to lack of

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nurses and an additional 1,700 to lack of both doctors and nurses. Lack of nurses was a cause contributing to the nonuse of more than one-third of the remaining 1,600 unused beds.

There are other figures even more revealing (*2*). Although 5.8 percent of the total occupied hospital beds in the country are used by tuberculosis patients, only 3.3 percent of the professional nurses working in all hospitals are employed in tuberculosis hospitals. In the general hospitals there is one professional nurse for each 2.5 patients while in tuberculosis hospitals there is one for each 10.6 patients. In the general hospitals there is one professional nurse for each 0.8 auxiliary nursing worker; in tuberculosis hospitals there is one for each 2.1 auxiliary nursing worker.

The above data indicate that the deficit of nurses in tuberculosis hospitals is not the only reason for closed beds. The tuberculosis patient needs care from a variety of workers, both professional and nonprofessional, many of whom are at a premium in the hospital labor market today. For example, doctors with a special knowledge of and interest in tuberculosis work are few in comparison with the many needed. Only a handful of medical social workers are employed in the tuberculosis field. In the hospitals, qualified dietitians are scarce or even absent. Housekeeping and maintenance departments are generally short staffed and in many instances the workers recruited are not of a high enough caliber and are not adequately trained to give satisfactory service without an excessive amount of supervision.

But it is with nursing that we are here primarily concerned. The care of the tuberculous patient should be a real challenge to a nurse. It requires the sympathetic approach and technical skills needed in all good basic nursing care. In addition, it calls for a knowledge of the disease, an understanding of the measures which can protect hospital personnel from it, and thoughtful consideration of the emotional and socioeconomic problems with which the patient needs help.

Why, then, does the tuberculosis service have great difficulty recruiting and keeping nursing personnel? (*3*)

To answer this question, we have studied approximately 45 tuberculosis services in general hospitals and in special hospitals and sanatoria in 12 States and the District of Columbia. The Philadelphia, Pa., area (referred to below as the community study area) was the one observed most intensively, and it is to conditions there that references are most frequently made in this paper. All of the institutions covered recognized the need for self improvement and requested that a survey of their facilities be made by the Public Health Service. It follows that, in general, hospitals with more complete services in which problems are being met by their own staffs were not visited.

Details of conditions in hospitals studied vary from community to community, but the over-all pattern occurs frequently enough to warrant thorough discussion. If this pattern is brought clearly into focus, we will, perhaps, be able to reach some definite conclusions as to what might be done to better it.

Does the Tuberculosis Hospital Offer a Nurse the Chance To Do a Good Job?

A young woman trying to choose between several nursing positions or fields weighs many different factors. Salary may be important to her, but it is likely to be less decisive than the satisfaction of being able to do a good job, a job that will help her patient get well and return to a useful life. In the especially expressive words of Dr. Esther Lucile Brown (*4*): ". . . to witness and also to influence growth, development, and change, not only in childhood but during all stages of life; to observe and treat the never absent but infinitely variable emotional component of disease; to be a participant in community efforts to protect health and to condition persons in the maintenance of health. What is the importance of 'unpleasant tasks' when compared with opportunities such as these?"

The tuberculosis hospital offers the nurse a difficult task, but it can be a highly interesting one. Here patients, infected with a chronic, communicable disease, often face serious personal upheavals which interfere with their receptiveness to the care which is essential to eventual recovery. They must be treated with understanding and freed from unnecessary strain and worry. One cannot give nursing care to a woman with tuberculosis, for example, without recognizing that a large factor in her eventual prognosis is her worry about how well the foster home is caring for her 18-month-old baby, nor to a manual worker without sensing that he will never be able to do hard labor again.

How Much Service Can She Give?

The average nurse wishes to give time to the refinements as well as to the essentials of nursing care. She knows, however, that in a job in an understaffed tuberculosis hospital, she would be under such pressure that she would be unable to meet her own standards as developed by her professional education and experience. Thus the vicious circle continues: There are not enough nurses in tuberculosis services and this situation creates conditions which in themselves keep nurses away.

Recommendations for standards of nursing care in tuberculosis hospitals were made as the result of a study in 1938 (*5*).[1] These were:

[1] For similar standards in general hospitals see reference (*6*).

In each 24-hour day, 3.3 bedside nursing hours per bed-surgical patient; 2.7, per bed-medical patient; 1.5, per semi-ambulant patient; 0.5, per ambulant patient.

Thirteen years have passed since these recommendations were made, and all too many of the tuberculosis hospitals and sanatoria have been unable to employ enough nurses to make them actualities. In one hospital studied, for instance, there was a 65-percent deficit in nursing care for each 24-hour day. In the community where 10 hospitals were studied, 2 general hospitals with comparatively small tuberculosis services which offered largely surgical care were the only ones which attained or exceeded the minimum hours of nursing care recommended.

The general hospitals in this area furnished a higher proportion of professional nursing care than the tuberculosis hospitals. An average of about 30 percent of the tuberculosis nursing care in the general hospitals was given by nonprofessional workers and 70 percent by professional nurses. About 40 percent was given by undergraduate students and 30 percent by graduate nurses. In tuberculosis hospitals, these figures were reversed: 70 percent of the care was given by nonprofessional workers and 30 percent by professional nurses. No part of the nursing care was provided by undergraduate professional nurses.

Too often one finds the tendency on the part of tuberculosis hospitals to use a lower standard of bedside nursing-care hours in staffing than that used by the general hospitals (*6*). Too often indeed, these tuberculosis hospitals have not accepted the principle that standards of care at least comparable to those attained in the medical and surgical wards of general hospitals should be provided. This approach might have been justifiable when tuberculosis was treated principally with rest, diet, and fresh air. But it certainly is not today, when modern treatment for the disease includes not only rest, but also surgery and extensive chemotherapy.

It is a credit to nurses everywhere that in spite of dire personnel shortages no specific instances which could be interpreted as neglect of patients were observed in the hospitals studied. Nurses are the first to point out deficiencies and are always most unhappy about them. They give critically ill patients priority for care; others have to get along with less than desirable. They are able to give little of the teaching or supervision of hygienic habits so necessary to getting well and staying well once discharged from the hospital. And how can they give adequate attention to education and details of protective measures when they must let patients who are supposed to be on complete bed rest make their own beds?

Are the Hospital's Physical Facilities Adequate?

Even if she is challenged by the opportunities for service in a tuberculosis hospital, a nurse might be discouraged with the prospect

of its facilities. Perhaps she won't mind its isolated location, but she is likely to object to the inconvenient, rambling manner in which so many sanatoria are constructed. One, for example, houses its 185 patients in 11 different buildings. Its nurses perforce waste much valuable time and effort walking. On balmy spring days this extra traveling might be a pleasure; in the rain or snow it is an unpleasant, time-consuming chore. In any event, since it is physically impossible to reach patients quickly either in routine situations or in such emergencies as sudden hemorrhaging, the patient is not assured of the care he needs.

Studies have shown the need for better planning of facilities for tuberculosis nursing care and through professional education and experience, nurses have learned a great deal to contribute to this planning. They well know, for instance, the importance of well-placed handwashing facilities. However, these, as will be seen in detail below, are sometimes nonexistent and frequently antiquated. Patients are generally admitted directly to the beds they will occupy during their stay since few hospitals have admission rooms or wards for them. There are usually not sufficient single rooms to provide for flexibility in segregation of patients and to permit individualized care on the basis of the needs of the patient. All such situations greatly magnify problems of nursing administration, waste professional time, contribute to staff dissatisfaction, and in these ways make for a lower standard of nursing service to patients.

Is She Protected From Undue Exposure by Protective Measures?

Nurses might be asked to put up with inconveniences, but it is quite another matter to expect them to care for patients without the means to protect themselves from a disease that is known to spread by contact. "In the tuberculosis ward or hospital," writes Dr. R. J. Anderson (7), "the nurse often finds the communicability of the disease treated lightly, and frequently finds doctors disagreeing about protective measures."

Effective protective measures for patient care should be agreed upon and accepted as essential in preventing the spread of tuberculosis. The principle underlying such measures is that tubercle bacilli must be destroyed as promptly and as near the source of dissemination as possible and that patients, visitors, and all concerned with patient care must share responsibility for these measures. The purpose is simple: to serve patients with clean supplies, equipment and food, with clean hands, in a clean environment. The most important of the measures which make the attainment of this purpose possible follow.

Personnel and Patient Education Programs. There are very few planned, coordinated educational programs to which all the various

professional disciplines in the hospitals make their special contributions. In many tuberculosis services these "programs," the success of which greatly influences the degree of contamination of the hospital environment, are limited largely to instruction in hospital regulations about rest or meal hours or care of sputum. Though routines may be wisely prescribed, the reasons underlying them are often inadequately explained. In hospitals where a large proportion of nurses have not had clinical experience in tuberculosis services, where much of the care is given by nonprofessional workers, where there is a high turnover of personnel, and where, as is always the case, effective protective measures are dependent upon the conscientiousness and practice of each individual, continuous staff education programs are essential.

Real knowledge of the disease is essential to gaining the patient's favorable response for his own care. It follows that it is also essential to the protection of all hospital personnel, while the patient is institutionalized, and to his family, after discharge. "The only real safeguards," according to Safer Ways in Nursing, "are the knowledge and understanding the nurse possesses, applies to herself, and passes on to patients. This knowledge should encompass the prevalence of bacteria, their menace to health, mode of transmission, pathways of entrance to the body, and particularly the means that may be employed to destroy them."

Emotional and Psychological Aspects of Protective Practices. Nurses who have worked extensively with patient education programs report that patients are the first to express a sense of relief when good practices are instituted. Personnel should always be concerned with patients' reactions to these practices and indeed should be aware of the psychological and emotional factors which are an integral part of nursing care. Good practices assist in overcoming fear of communicability of the disease. Accompanied by a vigorous in-service staff education program, they aid in attracting and keeping all personnel in tuberculosis services.

The Importance of Handwashing. If a hospital is to maintain environmental cleanliness, patients and workers must have hygienic habits. Since hands are a common medium of contact between workers and equipment and between patients and workers, clean hands are essential to the practice of aseptic technique. Our surveys indicate that the "when" of handwashing (after the hands are contaminated) is usually better taught than the "how" (by the use of soap, running water, and friction). Many tuberculosis hospital employees, particularly the nonprofessional personnel on the nursing staff, do not know what is meant by thorough and frequent handwashing as it is applied in communicable disease nursing, nor can they be expected to know without considerably more teaching and supervision.

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Moreover, handwashing facilities in most services are sadly inadequate and inconveniently located. Few have foot or knee water control; most water control is by hand-operated single faucets without gooseneck water mixers. A few institutions still offer their personnel handwashing facilities which can only be described as primitive: basins placed on tables in hallways.

Though paper towels are supplied for drying the hands of workers in most tuberculosis services, the common towel has by no means vanished. Even when paper towels are used, they are often in short supply and are sometimes hand drawn from a pile of towels on a window ledge or table, instead of from an approved dispenser.

Safe System for Disposal of Sputum. Since the chief source of tubercle bacilli is the secretions from the infected patient's nose and mouth, safe measures for the disposal of this material are highly significant. The majority of hospitals supply tissues for collection of sputum. Some use both sputum cups and tissues; most provide paper bags near the bedside for the immediate disposal of these tissues, with routine collection of bags, and final disposition by burning. On the whole, techniques in this field are fairly well regulated, though most of the hospitals studied could improve them by supplying nonpermeable tissues of proper size, by installing centrally located incinerators, and by thoroughly teaching the principles behind prescribed routines.

Cleansing and Sterilization of Utensils. Bedpans, urinals, hand basins, and emesis basins are often cared for in inconsistent fashion. For example, emesis basins for the care of sputum, the chief source of tubercle bacilli, are expected to be grossly contaminated. But they may be sterilized only once a week, while bedpans are sterilized after each use. Some institutions are completely without sterilizers for equipment used in the bedside care of patients. Ideally, all utensils should be sterilized after each use.

Thermometer Care. Procedures of thermometer care are often poorly planned and their practice is often haphazard. Three factors should be considered in planning for thermometer disinfection in tuberculosis services: First, tubercle bacilli are more difficult to destroy than most other organisms, and because of their presence in the patient's sputum, oral thermometers should be presumed to be grossly contaminated. Second, when chemical disinfection is relied upon for any article, it must first be thoroughly cleansed with soap, water, and friction and rinsed with clear water. Third, selection of the disinfection agent, its temperature, and the length of time of immersion in it, are all basic principles to be considered in the disinfecting process.

It is plain that these principles are violated when group technique is practiced and as many as 35 patients are given thermometers before

any are picked up; or when individual technique is used and thermometers are kept at the bedside, where effective cleansing and disinfection is generally lacking, and where they are stored in a contaminated area; or, when patients are "taught" to take their own temperature, and the practice is sloppy because it is usually not possible to give adequate professional supervision when the individual patient is relied on completely for taking his own temperature.

Some tuberculosis hospitals have evaluated the need for temperature taking on the basis of the use which is made of recorded data, and have found that about three-fourths of it could be eliminated without interfering with patient treatment. In any case, temperature taking procedures should be reviewed and revised periodically by medical and nursing staffs. When temperature taking is essential to diagnosis or treatment, it should be done by trained nursing personnel who practice a technique which will keep instruments free from tubercle bacilli. This is the simpler, safer, and more accurate way.

Protective Clothing. Routines concerning gown, cap, and mask protection differ considerably in the different hospitals. The nurse should be provided with a clean, ironed gown which covers her clothing completely when there is danger that it might be contaminated. In most institutions, however, gowns are used in a limited way, though in some they are employed as a matter of course in all patient areas. Lack of well-equipped gown rooms and a short supply of gowns often interfere with the planning and practice of good gown technique.

Caps which cover the hair completely help keep the hair free from tubercle bacilli from the patient's cough and from contaminated dust particles. They also prevent hair from falling over the face, offset the worker's tendency to brush it back with contaminated hands, and facilitate efficient wearing and removal of certain styles of masks. It is common practice, however, for nurses to wear only their regulation nursing caps on the job.

There is evidence to indicate that under carefully controlled procedures, masks do protect against the inhalation of tubercle bacilli (*9, 10*). However, experts believe that unless they are properly constructed, worn, handled, washed, and sterilized, they may be a hazard rather than a protection to the wearer. Mask techniques observed in tuberculosis services demonstrate the lack of understanding of the basic principles involved in good practice. Some use masks infrequently, others in selected areas, or while giving bedside care to patients only.

Supplementary Services Important to Protective Measures. Housekeeping, handling of clean and contaminated linens, laundry procedures, and food preparation, serving, and dishwashing are all extremely important to the sanitation and safety of the tuberculosis

hospital. Unless isolation techniques extend to these services, poor practice can negate much that is essential to a safe working environment. There is a real need for leadership, teaching, and supervision from the professional staff for personnel in these services who cannot be expected to have specific knowledge of communicable disease precautions.

Housekeeping. "The world in which the tuberculosis patient spends 24 hours a day is bounded by surfaces," says Safer Ways in Nursing. "When he is indoors he is surrounded by walls, floors, and ceiling. He wraps himself in garments and bed clothing. He uses a variety of furnishings and utensils. All of them become contaminated with dust and—what is more important—with tubercle bacilli . . . Good housekeeping in the care of the tuberculous patient, as of patients with other communicable diseases, serves several vital purposes. It makes the patient more comfortable, physically and mentally. It protects him from cross infection. It protects the uninfected from the organisms which cause disease" (*11*).

For all these reasons, professional guidance is needed in setting up housekeeping procedures. In institutions where nurses are in charge of housekeeping along with all their other responsibilities, there should be housekeepers to assist them. There is a good deal of merit in having the head nurse in a communicable disease service take some responsibility for housekeeping, but it should be only that part which strengthens her staff's contribution to safe nursing practices.

She could be responsible, for instance, for seeing that all dust and dirt are considered contaminated, handled gently and as little as possible, and disposed of promptly. Most institutions seem to realize this, but after the collection of dust there may be careless handling of dry sweepings. Often they are placed loose in trash cans or chutes where they have to be handled again by workers collecting for final disposal by burning.

She could also make sure that floors are considered contaminated by all personnel and are kept free from dirt, especially dry, loose dust. This is best accomplished by damp cleaning, and, when damp cleaning is not possible, by approved procedures for dust control (*12*). When sputum bags and contaminated linens are placed on floors, there is no real understanding of housekeeping principles in a communicable disease hospital.

Linen and laundry service. The patient's soiled bed linens, or his night gown or shirt, may be contaminated. Fortunately, standard laundering techniques can disinfect as well as clean, and if the hospital environment is to be a safe one, these techniques must be carried out efficiently. Laundry supervisors in hospitals have usually learned their business through experience and know how to handle their jobs. Nevertheless, they cannot provide patients with really clean linens

and clothes when the water at their disposal is not hot enough to maintain standards recommended by the American Institute of Laundering. In the community study area, 4 out of the 10 hospitals reported the water was not hot enough at peak requirements to destroy tubercle bacilli.

Food handling and dishwashing. The way in which food is handled and served is particularly significant in the tuberculosis service, since oral secretions are a source of contamination. If food is handled by healthy workers and cleanliness is maintained in food preparation and service, the possibilities of personnel conveying infections to patients and of patients conveying tubercle bacilli to healthy personnel are minimized.

Food should be prepared in hygienic surroundings, and preemployment health examinations should ascertain the food handlers' good health. On the job, these food handlers should be taught by supervision and demonstration some of the basic facts of asepsis. Such instruction is meaningless, however, if workers do not have ample facilities with which to carry them out. In many hospital kitchens there are no handwashing sinks, and food preparation sinks are used for this purpose.

It stands to reason that food should be served in such a way that transmission of tubercle bacilli is impossible. In most hospitals food for patients is cooked in kitchens separated from patient areas; in some, food for personnel is prepared in a separate kitchen. Separate dining rooms, or at least separate tables, are usually provided hospital personnel. In general, however, there is not enough thought given to contamination of food during and after its preparation. Milk especially should be received and served in the same single service container so that it will not change containers in contaminated areas several times before it is given to patients.

It is essential that dishes be thoroughly cleansed and sterilized after each use, and most services possess dishwashing machines to do the job. However, even a good machine needs maintenance, and operators need some professional supervision and instruction as to safe practices. In many of the hospitals observed, machines are not equipped with temperature control and no one has been careful enough to check on the hot water depended on to cleanse dishes. A typical hospital washes and rinses its dishes at 130° F., a temperature too cool to sterilize dishes. In many small institutions, dishes are washed by hand, and to disinfect them properly is a tedious job which requires even more supervision than a mechanical dishwasher.

Dishwashing problems, in fact all sanitation problems in the tuberculosis services, are, of course, tied up with the many problems of personnel administration. How can the dietitian in charge of the kitchen instruct the dishwasher as to the proper handling of his

machine when there is a 50-percent turnover in her staff every 2 weeks? And when the dishwasher doesn't arrive, how can the nurse give a high standard of care to her ill patient when she has to wash the dishes?

Is the Nurse Prepared for the Tuberculosis Service?

It is clear from the above that to function most effectively in the tuberculosis hospital, a nurse must acquire a detailed and extensive body of knowledge. She can begin to do this as a student in a school of nursing and continue later while actually on the job.

Progress is being made in providing experience in the care of tuberculosis patients as part of basic nursing education. Directors of schools of nursing are recognizing their responsibility in giving students both theoretical instruction and clinical experience in tuberculosis nursing, and affiliation courses within tuberculosis hospitals are gradually being developed.

But there is still a long way to go. In the community study area, for example, none of the three tuberculosis sanatoria offered affiliation programs for student nurses; they were not in a position to do so without considerable improvement in their facilities and nursing service. Four of the general hospitals with schools of nursing did give tuberculosis nursing courses in theory and clinical experience. Interestingly enough, of all the nurses graduated from nursing schools in this area, in the year 1947, 22 percent had received clinical experience in tuberculosis nursing. On the other hand, 50 percent of the graduate professional nurses employed in the tuberculosis services had received clinical experience in tuberculosis nursing in their basic nursing education. This would seem to indicate that a greater proportion of graduate nurses might enter the tuberculosis field if they had received clinical experience in tuberculosis nursing during their basic nursing education experience.

Once employed in the tuberculosis hospital, most nurses are given on-the-job instruction. Their formal orientation, however, should not stop there. Some few institutions do give the in-service class instruction so necessary to the many nurses who lack prior clinical experience. Where this is done, most administrators believe that in the long run it saves time, provides more efficient nursing care, and better equips the individual nurse to practice safe protective measures. Consequently, it affords her more protection while working in a contaminated environment.

Nurses should have access to professional library facilities if they are to add to their knowledge and keep up with current trends in tuberculosis. Yet these library facilities are lacking in many hospitals; in others they are limited or need a great deal of expansion. In most services there is also a need for a more liberal policy toward advanced

educational preparation in tuberculosis nursing, general nursing education, and administration. Our studies have shown that the proportion of nurses qualified in the administrative, teaching, and supervisory fields is much less in tuberculosis than in general hospital services.

Can the Tuberculosis Hospital Compete in the Hospital Labor Market?

Though there are more active nurses in the United States today than there have ever been before, the need for them has been greatly increased by modern developments. These include the tremendous scientific advances made in health fields, the gradual acceptance of the idea that each patient needs the best of care, the expansion of public health services, the increased use of nurses in industry, the spread of medical prepayment plans, the growth in the total population of the Nation, and the fact that a greater proportion of Americans are now in an older age group and are enjoying an all-time high standard of living.

As a result of all these factors, the hospital labor market is extremely competitive. As in its industrial counterpart, the employer who offers the most gets the best. The tuberculosis hospital, as we have seen, certainly needs the best, and yet its personnel policies often lag behind those employed by the general hospitals. This lag serves as still another deterrent to the recruitment of nursing personnel, for the whole community draws from the same pool of professional and nonprofessional nurses. In a defense situation such as that existing at present, the competition for personnel is of course aggravated.

Hours

Very few tuberculosis hospitals have attained the standard of a 40-hour week recommended by the American Nurses Association. Sanatorium nurses work from 44 to 67 hours a week while the average workweek for nurses in general hospitals is about 44 hours. One sanatorium studied, for instance, has two shifts per each 24 hours for its staff. Professional nurses work a 6-day week of about 52½ hours, exclusive of meal times. One day they work from 7 a. m. to 12:30 p. m. and from 6 to 10 p. m.; on alternate days they work from 7 to 10 a. m. and from 12:30 to 6 p. m. The permanent night staff works from 10 p. m. to 7 a. m. It is hard to see how a nurse can be ready to do a thorough job at 7 in the morning when she worked until 10 the night before. In another hospital night nurses work a 60½-hour week with equally irregular hours.

Vacations, Holidays, and Sick Leave

Policies governing vacations, holidays, and sick leave are more or

less uniform—most hospitals give 14 or 15 days of vacation with pay per year. Tuberculosis hospitals do tend to give less holiday time than do general hospitals and allow time off in choppy half-day, rather than full-day periods. Since the tuberculosis nurse works intimately with active cases of tuberculosis she needs rest and relaxation as a preventive measure. It would be a wise health policy to give her not less, but more, vacation, sick leave, and time off than are granted to nurses not in contact with a communicable disease.

Health Services

The health service offered personnel in the tuberculosis services is inadequate in far too many cases. Before a nurse is assigned to duty on a service, she should be given a general physical examination including a chest X-ray, a tuberculin test, and any other tests indicated. A general physical examination and chest X-ray should be repeated for everyone at regular intervals; a tuberculin test should be repeated for nonreactors at stated periodic intervals. Few tuberculosis hospitals, however, give prospective nurses routine preemployment physicals and some do not even give tuberculin tests, though preemployment and periodic X-ray is done almost everywhere.

And nurses, along with other tuberculosis hospital employees, do get tuberculosis. The reported percentage who contract the disease varies greatly, but there are studies which testify to a high rate of disease among physicians and nurses. Nurses, who are usually responsible for setting up protective measures in the services, realize that they are not safe unless all hospital employees are well protected. In the hospitals studied, student nurses generally have the best health services, graduate nurses less, and nonprofessional personnel in nursing, dietary, and housekeeping service often have little or none. At the request of the Council on Tuberculosis Nursing, a Committee of the American Trudeau Society, the medical section of the National Tuberculosis Association, is now considering the hazards involved for personnel working in tuberculosis services. It is expected that it will make recommendations which, if practiced, will better protect personnel.

Salaries

Salaries, too, are low and have not risen in proportion to the cost of living. Tuberculosis hospitals do furnish maintenance, or rooms, meals, and laundry service more often than do general hospitals, but this factor tends to be offset by the longer workweek of the tuberculosis nurse. Most important, in States where tuberculosis is not a legally compensable disease, nurses frankly state that they are more afraid of economic dependency as a result of the disease than of the disease itself. As one nurse put it, "Yes, the hospital would give me medical

and nursing care if I get tuberculosis, but who would feed my mother?"

Theodore C. Waters and Mary Graham Mack, in an article in the December 1950 issue of the American Journal of Nursing (*14*) report that as of October 1, 1950, occupational diseases were compensable under workmen's compensation laws in 40 States, the District of Columbia, Alaska, Hawaii, and Puerto Rico. Twenty-three States consider all occupational diseases compensable and 17 have laws compensating a list of specific diseases. In South Dakota, tuberculosis is included specifically in the list of compensable occupational diseases; in some States it is listed as a complication of silicosis. "In the States which provide compensation for any and all occupational diseases, if the nurse contracting tuberculosis is an 'employee' and the employment is covered by the statutes," say the authors, "it is our opinion that the administrative agency or courts would hold such claims to be compensable under the statutes, although we found reported court decisions in only four States." They add that nurses who seek workmen's compensation for tuberculosis should communicate with the agency in the State government which administers compensation.

Living Quarters

Inadequate, or very plain living quarters, are frequently the rule rather than the exception in tuberculosis services. Furnishings are likely to be poor and floors bare. Or there is not enough storage space, or sufficient light and air. In one hospital there were plenty of shower facilities, but almost half were out of order, and most lacked curtains. Since the quarters a hospital provides a nurse are often her home, every effort should be made to make them comfortable and attractive. Some institutions do succeed in doing this. One, for instance, arranges its living quarters like apartments, so that each four nurses have their own kitchen, bath, living room, and individual bedrooms.

Many hospitals give nurses the choice of living in their own or in hospital quarters. But they give little or no compensation for outside living arrangements and are often situated in such isolated locations that few nurses can live away, although most would prefer to do so. Nursing directors frequently report that the necessity for living in hospital quarters is a deterrent to recruiting and retaining personnel.

Transportation and Recreation

Transportation to hospitals is sometimes difficult and expensive, and nurses usually must bear the cost. Though they prefer, for the most part, to provide their own recreation, the high cost of transportation to places where it is available is also a deterrent to attracting and keeping all hospital personnel. Some institutions do run

buses into nearby cities to furnish transportation for recreational purposes.

Retirement Plans

Retirement plans are of rather recent origin in most tuberculosis hospitals as they are in general hospitals and other health services. Consequently, nurses now reaching retirement age have comparatively low benefits, since they have not participated in plans over a long period of years. Then too, income benefits, as in plans in other fields, are based on a standard too low to cover current living costs. When permitted, nurses must often continue working after retirement age to make a living.

In accordance with new social security laws, hospitals may, if they elect to do so, put their nursing employees under social security regulations. Nurses interested in further details are referred to an article titled "The New Social Security Law and the Nurse," in the November 1950 issue of the American Journal of Nursing (*15*). The authors, William C. Scott and Donald W. Smith discuss the effect of the new law on private duty or employed nurses. They report that it provides a "possibility of coverage" for employees of religious, charitable, educational, and similar institutions hitherto exempt from social security coverage. In order to obtain such coverage, a waiver of exemption must be filed and signed by the employer and at least two-thirds of the employees (non-nurses as well as nurses) of the institution or agency. The employees who sign the waiver and all new employees will then be required to pay the usual taxes and will be eligible for the usual benefits. The new law permits States and municipalities to obtain coverage for their employees by entering into voluntary agreements with the Federal Government. However, employees already covered by an existing retirement system of the State or municipality are not eligible for inclusion.

What Nursing Personnel Does the Tuberculosis Hospital Attract?

Professional

Under all these conditions, then, who, briefly, is the professional nurse the tuberculosis hospital does attract?

She is probably female, white, and single. If she is in a tuberculosis sanatorium she is, on the average, older than her colleague in the general hospital. Also, her educational attainments are lower, partly because general educational requirements for entrance into schools of nursing were lower at the time of her basic professional training. The chances are good that she received theoretical instruction in tuberculosis nursing in her basic nursing course; they are less than even that she

had clinical experience. Her opportunities for advanced preparation in general or in tuberculosis nursing are limited.

She changes jobs frequently, no doubt because of the variety of reasons discussed previously. One hospital reported a turn-over of both professional and nonprofessional personnel of 100 percent in a single year; another reported an 85 percent turn-over. She is likely to have been on the job a comparatively short time, although she does have some few colleagues who hardly ever change jobs. She probably has had no tuberculosis nursing experience as a graduate nurse previous to her present employment, nor any experience in other types of communicable disease nursing.

Nonprofessional

Because of the great need for nurses, the professional nurse's work is necessarily extended by that of the nonprofessional worker. In general, these nonprofessional nursing personnel have longer working hours, fewer days of paid vacation, and less health service than their professional colleagues. They have, as might be expected, less education. Some have received a little nurses' training and have been in schools of nursing and had their course interrupted by contracting tuberculosis.

By and large, the nonprofessional worker under the supervision of professional nurses can make a real contribution to the tuberculosis service. The ratio of professional to nonprofessional workers on the nursing staff should be studied in each particular hospital situation. As a guide: a minimum of one-third professional to two-thirds nonprofessional workers is indicated; most hospitals function more efficiently if a ratio of one-half professional to one-half nonprofessional is used. Often these goals are not attainable because of shortages of both professional and nonprofessional personnel. The interrelation of all these shortages and the effect of each on the total hospital picture needs more study.

The Hospital and the Community

It should be emphasized that the problems relating to the care of the tuberculous patient must be considered as a part of a program extending beyond the hospitals. A community's resources for the care of the tuberculous patient is found not only in its hospitals but in its community organizations, especially agencies which provide clinic and home services. Adequate social and welfare services are also essential to good medical care.

There must be cooperative planning by these agencies if there is to be an effective tuberculosis control program. Only by such planning can the patient and his family have complete and continuous care.

There is a great need for formulating policies and procedures for exchange of information about tuberculosis patients and their families within and between hospitals and agencies. This need extends far beyond nursing, of course, but it surely applies to nursing. When the public health nurse, for instance, can visit the tuberculosis patient in the hospitals, she finds a real means of strengthening her relationships with the patient's family.

Conclusions

Obviously it is not possible to improve tuberculosis services overnight. It will take many years, much effort, and a good deal of money before the tuberculosis hospital's physical facilities can be adequate or its personnel policies and patient care entirely satisfactory.

With imagination and intelligent planning however, the limited resources which are available can be used in such a way that the tuberculosis hospital will become a safer, more attractive place in which to be a worker or a patient. This will require the combined effort of all officials concerned, including those responsible for hospital administration, nursing service, and nursing education.

If these officials work carefully and cooperatively their accomplishments can be real indeed. One institution studied the ratio between its professional and nonprofessional workers. It decided it was in desperate need of professional nurses qualified in tuberculosis nursing and found them in nurses who were housewives willing to return to work on a part-time basis. Another considered staff assignments in detail and concluded that the patients' rest periods offered an ideal time for in-service training of personnel. It used this period for a variety of educational activities which, it turned out, directly improved patient care and bettered staff morale. Other hospitals have made recreational facilities more accessible by running busses or cars into nearby cities.

Even as they make full use of available resources, however, responsible officials must have concrete goals to be considered in planning for the unmet nursing needs of tuberculous patients. We suggest that, in general they strive:

1. To increase nursing services so that patients receive more adequate care through:
   a. The employment of additional professional nursing personnel in a proportion that can best be utilized for the particular hospital involved;
   b. Reevaluation and reassignment of responsiblities of professional and nonprofessional nurses to insure the best utilization of education and skills;
   c. Investigation of turnover of all types of personnel so that the

causes of this turnover may be determined, analyzed and used as an administrative tool in planning remedies.

2. To make physical facilities for care of the tuberculous patient safer, more efficient, and more attractive by establishing planning committees to consider new hospital construction or renovation and improvement of existing facilities. Since nurses have, through their professional education and experience, gained much knowledge which would be of use to these committees, they should be given the opportunity to contribute to them.
3. To give the nurse the chance to practice protective measures in order to provide her and others in the hospital with a safe working environment.
4. To decrease the lag in personnel policies in effect in tuberculosis hospitals as compared to those in general hospitals by:
   a. Improving them to equal or better policies recommended by the American Nurses Association;
   b. Studying total personnel needs and the relative importance of all workers, professional and nonprofessional, to the whole picture;
   c. Expanding and strengthening the health programs for all types of personnel.
5. To enable the nurse to acquire a sound education in tuberculosis nursing by:
   a. Establishing more affiliation courses as a part of the basic nursing program in tuberculosis hospitals;
   b. Continuing and expanding supplemental education and advanced courses in tuberculosis nursing for graduate nurses;
   c. Continuing and expanding organized and planned courses for nonprofessional nursing personnel under professional guidance;
   d. Continuing and expanding vigorous staff education programs in the tuberculosis service.
6. To enable the hospital to consider the over-all care of the patient through:
   a. Aiding hospitals and agencies in cooperative planning on a community-wide basis;
   b. Improving record systems, and planning for free exchange of information between hospitals and community agencies;
   c. Working for community-wide support of legislation which would include tuberculosis as a compensable disease for workers in tuberculosis services.

If administrators, physicians, nurses, and, in fact, all concerned with patient care keep these goals in mind and use some imagination and much ingenuity, tuberculosis hospitals can improve. They can indeed be made into satisfying places in which to work, where pa-

tients are given adequate treatment and are returned to their homes and communities as happy, useful citizens.

ACKNOWLEDGMENT

The unpublished report of a detailed study of tuberculosis control in the Philadelphia Area inspired the preparation of this paper. The author wishes to thank Fannie Eshleman, R. N., of The Henry Phipps Institute and Gertrude K. Langton, R. N., of the Philadelphia Tuberculosis and Health Association, chairman and co-chairman, respectively, of the Nursing Committee for the Philadelphia Tuberculosis Survey, and the other members of the committee for their valuable contributions.

REFERENCES

(*1*) Index of hospitals with tuberculosis beds in the United States and Territories as of January 1, 1950. PHS Publication No. 32, Washington, D. C., U. S. Government Printing Office.

(*2*) Arestad, F. H., and McGovern, Mary A.: Hospital service in the United States. J. A. M. A. **143**: 25–37 (1950).

(*3*) Deming, Dorothy: The Practical Nurse. New York, The Commonwealth Fund, 1947, pp. 100–113.

(*4*) Brown, Esther Lucile: Nursing for the Future. A report prepared for the National Nursing Council. New York, Russell Sage Foundation, 1948.

(*5*) The National Tuberculosis Association, the American Nurses' Association, the National League of Nursing Education, and the National Organization for Public Health Nursing: A study of the nursing care of tuberculosis patients. Am. J. Nursing **38**: 1021–1037 (1938).

(*6*) American Hospital Association and National League of Nursing Education: Hospital Nursing Service Manual. New York, National League of Nursing Education, p. 30, 1950.

(*7*) Anderson, Robt. J.: Editorial—Nursing in tuberculosis. Pub. Health Rep. **64**: 121–122 (1949).

(*8*) Joint Tuberculosis Nursing Advisory Service: Safer Ways in Nursing to Protect Against Tuberculosis. New York, National Tuberculosis Association, 1948, p. 31.

(*9*) Lurie, Max B., and Abramson, Samuel: The efficiency of gauze masks in the protection of rabbits against the inhalation of droplet nuclei of tubercle bacilli. Am. Rev. Tuberc. **59**: 1–9 (1949).

(*10*) McNett, Esta H.: The face mask in tuberculosis. Am. J. Nursing, **49**: 32–36 (1949).

(*11*) Joint Tuberculosis Nursing Advisory Service, op. cit., p. 56.

(*12*) Ibid, p. 59.

(*13*) Connolly, Eleanor: Tuberculosis Among Hospital Personnel. New York, National Tuberculosis Association, 1950.

(*14*) Waters, Theodore C., and Mack, Mary G.: Is tuberculosis compensable? Am. J. Nursing, **50**: 776 (1950).

(*15*) Scott, William C., and Smith, Donald W.: The new social security law and the nurse. Am. J. Nursing, **50**: 686–688 (1950).

What Is a Reportable Case of Tuberculosis?

The reporting of cases is indispensable to the control of tuberculosis. A health department cannot discharge its responsibilities for the supervision of cases and the examination of contacts if all cases identified in its jurisdiction are not brought promptly to its attention. The case that is reported first on a death certificate represents to the tuberculosis controller a disheartening frustration of his aims.

Furthermore, reliable information about the extent of the problem is necessary for intelligent planning of control programs. In the 30 years of almost universal compulsory reporting of tuberculosis in this country, there has been so little agreement on definitions of reportability or uniformity in reporting practices that available tuberculosis morbidity data have represented only makeshift estimates. Mortality rates have been used as a measure of control needs in spite of growing awareness of their inadequacy for that purpose. In recent years, the rapid decline in the death rate has quite evidently not been accompanied by a commensurate decline in morbidity. As case-finding efforts are carried on with increasing vigor and more cases are discovered in the minimal stage, and as new drugs and other methods of therapy prolong the lives of tuberculosis patients, it is apparent that mortality rates are no longer an accurate current guide to the tuberculosis problem. There is greater need for better reporting of all cases.

To be really useful, moreover, tuberculosis case reporting should conform to commonly accepted standards. Data are of little use if some reflect all cases including suspects, while others show only active cases with positive bacterial findings.

Recognizing that the epidemiology of tuberculosis would continue to be based largely upon presumptions and not upon facts until case reporting was standardized, the Joint Meeting of the State Tuberculosis Control Officers and State Sanatoria Directors in 1949 recommended the appointment of a committee to study the problems of tuberculosis morbidity reporting and to try to work out solutions. Members of the committee appointed by Dr. R. J. Anderson, Chief, Division of Tuberculosis, Public Health Service, represent States in widely separated parts of the country, with various population characteristics and tuberculosis control patterns. They are:

From the Division of Chronic Disease and Tuberculosis

Dr. C. M. Sharp
Director, Bureau of Tuberculosis, Florida State Board of Health

Dr. Richard M. Burke
Director, Division of Tuberculosis Control
Oklahoma State Health Department

Dr. Edward X. Mikol
General Director of Tuberculosis Hospitals
Division of Tuberculosis Control
New York State Department of Health

Dr. Edward Kupka
Chief, Tuberculosis Service
California State Department of Public Health

Dr. Cedric Northrop
Head, Tuberculosis Control Section
Washington State Department of Health

Dr. Hilbert Mark[1]
Tuberculosis Control Officer
Division of Preventable Diseases
Minnesota Department of Health

Dr. Paul S. Phelps
Director, Connecticut State Tuberculosis Commission

This committee has met several times in the past 2 years and has considered in detail the ramifications of the assigned subject. They have dealt with exceedingly perplexing questions, and their final report, which was accepted by the joint meeting in May of 1951, is a valuable contribution to tuberculosis control.

The committee was not concerned with criteria for the diagnosis of tuberculosis. These are defined in Diagnostic Standards and Classification of Tuberculosis, published by the National Tuberculosis Association, a new edition of which was issued in 1950. The Committee on Tuberculosis Mobidity Reporting used this publication in its work, but its problem was to define standards for the reporting of cases, not for diagnosis.

The report provides for standards for tuberculosis reporting which are sufficiently flexible to allow for the differing needs and regulations of the various States and, at the same time, furnish comparable data. The recommendations of the committee also provide for some local variation in the selection of reportable cases and in the mechanism of reporting. If they are followed, however, they will yield significant information which has heretofore been lacking.

The tuberculosis control officers and State sanatoria directors, in accepting the committee's recommendations, indicated their interest in improving the status of tuberculosis morbidity reporting. We now have the means to eliminate the confusion which has accompanied tuberculosis case reporting. This is possible only if action is taken by all health jurisdictions to adopt the committee's proposals. The ultimate effectiveness of the committee's work will depend upon general application of their recommendations which are set forth in the following report.

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[1] Served on committee from August 1949 to December 1950. At present Director of the Division of Tuberculosis Control, Denver City Health Department.

Report and Recommendations of the Committee on Tuberculosis Morbidity Reporting, May 14, 1951

I. Purposes of Reporting Tuberculosis Cases

The primary purposes of tuberculosis morbidity reporting are:

A. *For case supervision.* To assure continued medical supervision, isolation, and follow-up of all known cases as long as may be necessary to prevent spread of the disease.

B. *For contact supervision.* To facilitate the examination of contacts of all known cases.

C. *For program management.* To provide information for use in:

1. Determining the extent and characteristics of the tuberculosis problem, and
2. Evaluating the effectiveness of tuberculosis control measures.

II. Medical Criteria for Reporting Tuberculosis Cases

A. *To be reported.* The following cases should be reported:

1. Cases with tubercle bacilli demonstrated.
2. Cases with other significant evidence, even though bacteriological proof has not yet been demonstrated, such as:
   a. Chest X-ray shadows characteristic of active tuberculosis (soft infiltrate, cavity, etc.);
   b. Unexplained pleurisy with effusion;
   c. Clinically active extra-pulmonary tuberculosis (meningeal, bone, kidney, etc.).

B. *May be reported.* The following previously unreported tuberculosis cases may be reported:

1. Cases of pulmonary fibrosis and nodulation more than minimal in extent, presumably of tuberculous origin.
2. Cases with a record of active disease or previous treatment within the past 5 years.
3. Cases with X-ray evidence of collapse therapy or resection for tuberculosis.
4. Active primary pulmonary tuberculosis cases.

C. *Not to be reported.* The presence of the following should not be considered sufficient evidence for reporting:

1. Chest X-ray film revealing fibrous lesions, minimal in extent, without history or symptoms. (This includes fine linear strands; discrete, hard nodules; and apical-pleural scars.)
2. Positive tuberculin reaction only.
3. Pulmonary calcification, including healed primary tuberculosis.
4. Healed extra-pulmonary tuberculosis.

III. Report Forms

A. *Methods of reporting.* The committee makes no specific recommendations as to the type of report form which should be used, except that each case should be reported on an individual form. It recognizes that there are at least four satisfactory methods of reporting:

1. General morbidity report form followed by a special tuberculosis morbidity report form.
2. Special morbidity report form for all cases of tuberculosis.

3. Special morbidity report form for initial use by certain sources of reports such as clinics and tuberculosis hospitals; other sources to use method in 1, above.

4. Combined general morbidity report form with a section for special tuberculosis information.

The committee feels that a general morbidity report without the minimum medical information indicated in C, below, is inadequate.

B. *Minimum identifying information.* Name, address (present and usual, if different); age, sex, and race; source of report; date reported; was case first found on miniature X-ray?

C. *Minimum medical information*

FORM AND EXTENT	ACTIVITY STATUS	BACTERIAL STATUS
Pulmonary	Active*	Positive
Minimal		
Moderately advanced	Activity undetermined	Negative
Far advanced	Probably active*	
Other, specify--------	Probably inactive	Unknown
Nonpulmonary, specify----	Arrested	
	With positive bacteria findings*	
	With negative bacteria findings	
	Inactive	

D. *Optional information.* Occupation; marital status; veteran status; length of State residence; date of last laboratory examination; date of last X-ray examination; if reported after death, date of death. Was diagnosis verified by X-ray, laboratory examination, or autopsy? Method of laboratory examination (direct smear, concentrated smear, culture, animal inoculation). Who is to supervise the case?

IV. Administrative Procedures

A. A newly reported tuberculosis case in any State is one which, in addition to meeting the medical criteria presented above, has never been previously reported to the State.

B. There should be a reasonable amount of screening and querying for the purpose of improving reporting and the comparability of data.

C. Tuberculosis cases are sometimes first reported to health departments by Federal, State, or local agencies or physicians by telephone, letter, or forms other than the official morbidity report (Veterans Administration form, clinic examination reports, death certificates, interstate report notices, etc.). Information on such cases should be entered on the official morbidity report form so that they may be counted as new cases.

D. The following are the recommended procedures for counting cases on an annual basis:

1. A case is counted in the year in which it is reported, provided that the report is received by the State health department by January 31 of the following year. If received after that date, it is counted in the year in which it is received.

2. When follow-up information which reverses the diagnosis or otherwise provides a basis for not counting a case is received during the year the case was reported, or during January of the following year, the case is deleted from the count. However, if such information is received after January 31 no change is made in tabulations of newly reported tuberculosis cases.

E. Active and probably active tuberculosis cases, as defined in section II. A., shall always be tabulated as a group and separately from the cases in the optional categories of section II. B. Tabulations made by stage of disease should also follow this grouping of activity status, as should tabulations for other characteristics such as age, sex, and race. In this way a reasonable degree of comparability between States will be achieved.

*Cases in these classifications shall always be reported. Whether or not cases in the other classifications of activity status are reported will be determined by State policy.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended September 15, 1951

Totals of 48 cases of malaria in civilians and 185 in military establishments were reported for the current week as compared with 55 and 230, respectively, for the previous week.

The total reported cases of poliomyelitis in the Nation decreased from 1,871 last week to 1,797 for the current week. Since the seasonal low week, a cumulative total of 16,121 cases has been reported, compared with 16,238 for the corresponding period in 1950. The cumulative total for the calendar year is 17,333 compared with 17,369 for the 1950 calendar year. The cumulative totals for the current seasonal and calendar years include 17 delayed case reports of poliomyelitis from Virginia for the current week. These delayed reports are excluded from the total for the current week for the Nation.

There was an increase in the number of cases in only two of the nine geographic divisions—the West North Central and the Pacific—as compared with the previous week. The increase was not marked in either group.

The decrease in the total reported cases of poliomyelitis in other areas was slight to moderate.

For the week ended September 8, a number of States reported more than 100 cases each. In New York State, which reported a total of 128 cases, 55 were in New York City, 13 in Essex County, and 11 in Nassau County. Illinois reported 108 cases of which 55 were in Cook County. No other county reported more than 5 cases. Michigan had a total of 120, 47 occurring in Wayne and 22 in Oakland Counties. In Wisconsin, 40 of the 106 cases were in Milwaukee and 13 in LaCrosse Counties. No report has been received on county distribution from Ohio where 102 cases were reported. In California, 53 of the 117 cases reported were in Los Angeles County and 11 in San Francisco.

The cases in Colorado continued to be concentrated in the Denver and Pueblo areas, while in Utah, 38 of the 43 cases reported for the week ended September 8 were in Salt Lake, Utah, and Weber Counties.

Dr. C. C. Kuehn, Louisiana Department of Health, has supplied

information to explain the sudden increase in the number of cases of poliomyelitis from 27 for the week ended September 1 to 100 cases for the following week. A backlog of unreported cases developed because new personnel misunderstood reporting procedures. A diagnostic breakdown on the type of disease (paralytic or nonparalytic) is required and this also provokes a delay in reporting. It was discovered that a military establishment had failed to report cases. The newly reported cases in Louisiana when graphed as to date of onset actually show a decreasing number during the past few weeks.

Dr. R. W. Williams, Area Medical Officer for the Office of Indian Affairs, has reported 3 additional cases of poliomyelitis among the Indians living in the area near Hayward, Wis. A total of 17 cases has occurred in this group, none of them fatal but several exhibiting symptoms necessitating the use of a respirator.

Epidemiological Reports

Food Poisoning

Dr. Malcolm H. Merrill, California Department of Health, reports that 6 cases of food poisoning occurred in a group of 15 persons who drank lemonade. Severe vomiting occurred 10 minutes to several hours after drinking the lemonade which had been prepared and stored

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Sept. 15, 1951	Sept. 16, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	-------	-------	-------	(1)	(1)	(1)	(1)	46	30	38
Diphtheria (055)	60	97	199	27th	512	754	1,354	2,520	3,882	5,964
Encephalitis, acute infectious (082)	34	24	24	(1)	(1)	(1)	(1)	[2] 744	655	463
Influenza (480–483)	342	339	339	30th	1,982	2,391	2,297	118,037	141,155	130,724
Measles (085)	873	518	518	35th	1,746	1,024	1,030	470,657	289,195	552,938
Meningitis, meningococcal (057.0)	51	46	46	37th	4,022	3,712	3,613	3,061	2,799	2,641
Pneumonia (490–493)	497	662	(3)	(1)	(1)	(1)	(1)	47,848	63,493	(3)
Poliomyelitis, acute (080)	1,797	2,146	1,839	11th	[4] 16,121	16,238	15,672	[4] 17,333	17,369	16,022
Rocky Mountain spotted fever (104)	5	12	12	(1)	(1)	(1)	(1)	283	406	478
Scarlet fever (050) [5]	325	344	433	32d	[6] 1,304	1,401	1,773	[6] 54,690	41,571	58,992
Smallpox (084)	-------	-------	-------	35th	-------	-------	1	11	26	50
Tularemia (059)	16	17	18	(1)	(1)	(1)	(1)	494	708	731
Typhoid and paratyphoid fever (040, 041) [7]	102	92	108	11th	1,730	1,996	2,260	2,165	2,506	2,745
Whooping cough (056)	1,011	1,889	1,889	39th	[8] 73,305	115,309	98,303	[8] 51,703	93,773	72,285

[1] Not computed.
[2] Deduction: North Carolina, week ended August 18, 1 case.
[3] Data not available.
[4] Addition: Virginia, delayed report, 17 cases—not allocated. Deductions: Mississippi, week ended August 25, 3 cases; North Carolina, week ended August 4, 1 case.
[5] Including cases reported as streptococcal sore throat.
[6] Addition: Minnesota, week ended September 8, 4 cases.
[7] Including cases reported as salmonellosis.
[8] Addition: West Virginia, week ended September 8, 36 cases.

5 hours in a silver plated pitcher. The copper alloy base was exposed in the pitcher. Lemonade similarly prepared in the laboratory yielded 82 parts per million of copper.

Botulism

A delayed report of three cases of botulism has been received from Dr. Giedt. The cases occurred in Grant County late in June 1951. A family of five ate asparagus salad made from home canned asparagus prepared 2 weeks before serving. The mother and a 15-year-old son ate the greatest amounts of the salad; a 4-year-old son ate a small amount, while the father and a daughter ate none. The 4-year-old child became ill soon after eating, with vomiting, but recovered. The mother and older son became increasingly ill with nausea, vomiting, double vision, and dyspnea. Both died. A sample of the asparagus revealed *Clostridium botulinum*, type A.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Sept. 15, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	60	34	342	873	51	497	1,797
New England			2	109	1	16	54
Maine			1	11		4	5
New Hampshire				8			4
Vermont				16			
Massachusetts				42	1		26
Rhode Island				11			1
Connecticut			1	21		12	18
Middle Atlantic	8	12	4	246	7	60	237
New York	6	11	(1)	164	3		132
New Jersey		1	4	52	1	22	51
Pennsylvania	2			30	3	38	54
East North Central	3	2	17	207	16	32	447
Ohio	2			23			80
Indiana		1	16	9	1	3	25
Illinois		1	1	65	7	26	132
Michigan	1			37	6	3	110
Wisconsin				73	2		100
West North Central	1	6	3	28	2	51	265
Minnesota		1	1	6	1	15	47
Iowa	1	1		1			21
Missouri				5	1		79
North Dakota			2	9		35	9
South Dakota		4		1			14
Nebraska				2			38
Kansas				4		1	57
South Atlantic	24	2	168	73	8	54	112
Delaware					1		
Maryland			1	22		11	11
District of Columbia				6		14	3
Virginia	3		165	19	2	24	14
West Virginia	2			12	1		10
North Carolina	14			3	1		18
South Carolina	3		2	1		1	17
Georgia	2			8	1	4	29
Florida		2		2	2		10
East South Central	15	2	3	25	7	73	110
Kentucky	4			6		25	21
Tennessee	1			14	4		34
Alabama	4	1		2	3	13	29
Mississippi	6	1	3	3		35	26
West South Central	7	3	39	41	3	152	198
Arkansas		1	20	3		8	25
Louisiana						33	52
Oklahoma	1		19	5	1	10	34
Texas	6	2		33	2	101	87
Mountain	1		86	61		21	180
Montana	1		9	22			11
Idaho				3			6
Wyoming				2			26
Colorado			2	7		10	67
New Mexico			1	8		3	6
Arizona			74	13		8	11
Utah				6			49
Nevada							4
Pacific	1	7	20	83	7	38	194
Washington			12	25		2	22
Oregon			3	15	3	19	14
California	1	7	5	43	4	17	158
Alaska [2]							
Hawaii				28			1

[1] New York City only.

[2] Report from Alaska was not received.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Sept. 15, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	5	325		16	102	1,011	117
New England		17		1	9	64	
Maine		3			3	7	
New Hampshire		1				2	
Vermont						1	
Massachusetts		8		1	3	41	
Rhode Island		2				3	
Connecticut		3			3	10	
Middle Atlantic	1	55			16	223	14
New York		14			3	81	8
New Jersey		8			3	62	
Pennsylvania	1	33			10	80	6
East North Central		74		2	5	219	12
Ohio		16			1	39	3
Indiana		8				25	4
Illinois		13		1		35	
Michigan		24			4	79	3
Wisconsin		13		1		41	2
West North Central		16		1	10	48	13
Minnesota		6				2	7
Iowa		3			8	11	2
Missouri		1			1	14	3
North Dakota		1				5	
South Dakota		3			1	2	
Nebraska							1
Kansas		2		1		14	
South Atlantic	3	46		3	8	116	20
Delaware						1	
Maryland	1	2				3	
District of Columbia		2				4	
Virginia		8			1	51	7
West Virginia		6				25	2
North Carolina	2	13		1	1	10	
South Carolina		1			2		7
Georgia		9		2	4	6	4
Florida		5				16	
East South Central	1	26		2	15	48	25
Kentucky		10			7	21	14
Tennessee	1	11			5	8	4
Alabama		1				4	3
Mississippi		4		2	3	15	4
West South Central		11		4	20	196	32
Arkansas					1	21	4
Lousiana		1			7	5	
Oklahoma					4	17	3
Texas		10		4	8	153	25
Mountain		15		1	7	45	
Montana		1				5	
Idaho		6				4	
Wyoming		1		1	1	3	
Colorado		3			5	22	
New Mexico						7	
Arizona					1	4	
Utah		4					
Nevada							
Pacific		65		2	12	52	1
Washington		10				8	
Oregon		9				2	
California		46		2	12	42	1
Alaska [3]							
Hawaii							

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.
[3] Report from Alaska was not received.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Sept. 1, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	10	-	-	-	-	3	5	1	1	-	-
Chickenpox	140	1	-	1	-	10	59	10	7	26	26
Diphtheria	1	-	-	-	-	1	-	-	-	-	-
Dysentery, bacillary	29	-	-	-	-	5	2	-	-	-	22
German measles	54	-	-	1	-	14	15	2	4	11	7
Influenza	10	-	-	3	-	-	-	1	-	-	6
Measles	176	18	-	10	2	13	27	10	9	53	34
Meningitis, meningococcal	6	1	-	1	-	1	1	1	-	1	-
Mumps	116	1	-	1	1	9	42	11	5	26	20
Poliomyelitis	168	-	-	24	1	16	108	1	11	2	5
Scarlet fever	87	1	-	-	-	21	8	28	7	11	11
Tuberculosis (all forms)	149	3	-	5	18	40	15	17	4	13	34
Typhoid and paratyphoid fever	4	-	-	-	-	2	-	-	-	-	2
Venereal diseases:											
Gonorrhea	360	5	-	1	4	89	46	33	34	45	103
Syphilis	113	3	-	2	11	52	17	2	16	1	9
Primary	5	-	-	-	1	3	-	-	1	-	-
Secondary	7	-	-	-	-	4	2	-	1	-	-
Other	101	3	-	2	10	45	15	2	14	1	9
Whooping cough	208	-	-	9	-	48	79	20	8	23	21

CUBA

Reported Cases of Certain Diseases—4 Weeks Ended Aug. 25, 1951

Disease	Total	Pinar del Rio	Habana		Matanzas	Santa Clara	Camaguey	Oriente
			Habana City	Total				
Cancer	116	4	-	32	14	24	17	25
Chickenpox	3	-	-	-	-	-	-	3
Diphtheria	10	-	2	5	3	-	-	2
Leprosy	2	-	-	2	-	-	-	-
Malaria	7	-	-	-	-	-	-	7
Measles	21	-	11	16	2	-	-	3
Poliomyelitis	2	-	-	-	-	-	-	2
Scarlet fever	1	-	1	1	-	-	-	-
Tuberculosis	90	1	4	22	18	29	9	11
Typhoid fever	36	6	6	8	4	7	3	8
Whooping cough	1	-	-	1	-	-	-	-

JAMAICA

Reported Cases of Certain Diseases—3 Weeks Ended Aug. 25, 1951

Disease	Total	Kingston	Other localities
Chickenpox	4	2	2
Leprosy	1	1	
Poliomyelitis	1		1
Scarlet fever	1		1
Tuberculosis, pulmonary	37	9	28
Typhoid fever	49	1	48
Typhus fever	1	1	

NOTE.—Week ended Aug. 4 not included in above table. No report for that week was received from Jamaica.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Cholera

Burma. For the period August 26–September 1, six cases of cholera were reported in Tavoy.

India (French). For the period August 21–31, a total of 65 cases and 33 deaths from cholera was reported in French India. Included in the total were 63 cases and 32 deaths in Pondicherry dependencies. For the preceding period, August 11–20, a total of 127 cases and 68 deaths was reported in French India. Included in the total were 117 cases and 62 deaths in Pondicherry dependencies.

Plague

Ecuador. For the period July 1–31, a total of 10 cases and 6 deaths from plague was reported in Canar County.

Madagascar. For the period August 1–31, a total of five cases and four deaths from plague was reported in Madagascar. Included in the total were four cases and three deaths in Fianarantsoa and one case and one death in Tamatave. For the preceding period, July 1–31, a total of six cases and six deaths was reported. Included in the total were two cases and two deaths in Fianarantsoa, one case and one death in Tamatave, and three cases and three deaths in Tananarive.

Union of South Africa. For the period August 10–16, a total of four cases and one death from plague was reported in Barkly West District, Cape Province. For the preceding period, August 3–9, a total of one case and one death was reported in the same area.

Smallpox

Ecuador. For the period July 1–31, a total of eight cases and one death from smallpox was reported from Ecuador. Included in the total were two cases in Quito.

Indochina. For the period August 26–September 1, a total of 33 cases of smallpox was reported in Viet-Nam. Included in the total were 3 cases in Haiphong and 30 cases in Hanoi.

Yellow Fever

Costa Rica. For the period August 17–21, a total of five deaths from jungle yellow fever was reported in Costa Rica. Included in the total were the following: Los Angeles one, San Jorge one, and Sardinal one, in Rio Cuarto Sarapiqui Zone, Alajuela Province; Venecia one, in San Carlos County, Alajuela Province; and one death in Siquirres County, Limon Province.

French West Africa. On September 6, one suspected case and one death from yellow fever were reported from Parakou, Dahomey. The suspected case was in a male European who died at Parakou, which is about 320 miles north of Cotonou.

Venezuela. On August 11, one death from jungle yellow fever was reported in Mara de Madera, Bolivar State. The case occurred about 16 miles west of Tumeremo in the jungle area.

The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

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Public Health Reports

VOLUME 66 **OCTOBER 12, 1951** NUMBER 41

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The Toxicity of Some Related Halogenated Derivatives of Phenol

By E. F. Stohlman*

As a result of preliminary field trials to determine the molluscacidal activity of 10 organic compounds previously laboratory tested, Nolan and Berry (*1*) reported pentabromophenol and sodium pentachlorophenate showed promising molluscacidal activity. As this work was extended and additional field tests were made, Berry et al. (*2*) subsequently reported the marked molluscacidal effectiveness of the same compounds and of four others against *Australorbis glabratus* in endemic areas of schistosomiasis in Puerto Rico. These compounds served as the basis for the toxicity studies reported here.

Experimental Procedures

The compounds, pentachlorophenol, the copper salt of pentachlorophenol, pentabromophenol, 2,4,6-tribromophenol, the sodium salt of 2,4,6-triiodophenol, 2,4,6-triiodophenol, and Santobrite [1] used in this work were supplied by the Laboratory of Tropical Diseases of the National Institutes of Health. They were samples of the same lots of the respective compounds employed in the previous work (*1*, *2*).

The solutions were made up daily. The water soluble sodium derivatives were obtained by adding the theoretical amount of sodium hydroxide to each compound, except the sodium salt of 2,4,6-triiodophenol which was used directly. The copper salt of pentachlorophenol was administered as a suspension in Tween 20 because of its insolubility in water. Santobrite was readily water soluble and was administered as an aqueous solution. The compounds were administered by stomach tube to growing female rats. For the most part, all doses were administered in the same volume of 10 cc. per kilo. Dosages have been expressed in terms of the active ingredient present in the

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[1] Registered trade name for Monsanto's sodium pentachlorophenate, labeled; sodium pentachlorophenate 79 percent; sodium salts of other chlorophenols 11 percent; inert ingredients 10 percent. The trade names are carried as a means of identifying the products under discussion and do not represent endorsement of the products by the Public Health Service.

samples, except those of Santobrite which have been expressed as such.

In the acute toxicity experiments, a single administration was given, whereas in the subacute toxicity, five successive daily administrations were given except where otherwise indicated. The animals were kept in metabolism cages and fed ground Purina Chow Pellets [2] and water ad libitum. Animals were observed for about 1 week preceding, and a minimum of 11 days following, administration of the drug. The animals were weighed immediately preceding, and daily during, the course of administrations; otherwise, at 3–5 day intervals. A record of the amount of food consumed was maintained. Autopsies were regularly performed on animals dying during the course of the study and on all survivors at the end of the observational period. No attempt was made to note other than gross changes, and no examination was made of brain and spinal cord.

Results

Acute Toxicity

The results are shown in table 1. The LD_{50} was determined only in the case of Santobrite and was 100 mg. per kilo. The approximate LD_{50} in mg. per kilo of pentachlorophenol was between 125 and 200; the copper salt of pentachlorophenol, about 600; pentabromophenol, slightly more than 200; 2,4,6-tribromophenol, less than 2,000; the sodium salt of 2,4,6-triiodophenol, more than 2,500; and 2,4,6-triiodophenol, less than 2,500.

The consistency with which symptoms were produced, the degree of their intensity, and the rapidity of their onset in all animals receiving identical doses of a given compound indicated relatively rapid and uniform absorption of all compounds from the gastrointestinal tract, except the copper salt of pentachlorophenol. With this compound there was a lack of uniformity of symptoms produced and a relatively wide range in dosage producing equivalent lethal effects.

In general, the symptoms produced by all the compounds, except pentabromophenol, were characteristic of those produced by pentachlorophenol and consisted of an increased respiratory rate and amplitude, followed by loss of muscle tone, collapse, and death in animals sufficiently poisoned. The symptoms from pentabromophenol were increased respiratory rate and amplitude, with general body tremors, occasional convulsions, and death in animals sufficiently poisoned. With certain differences, they simulated those of DDT poisoning in the rat *(3)*; the whole syndrome appeared to be a more rapid version of DDT poisoning. The onset of symptoms was a matter of a few minutes compared to 4–6 hours with DDT. Depending upon their severity, their duration was a few minutes to about 3 hours, ending in

[2] A commercial product said to provide all the essential elements necessary for normal growth and development of rats.

Table 1. *Acute toxicity of certain halogenated derivatives of phenol in rats,*[1] *by oral administration*

Series	Dose gm/kg	Diluent	Number dead/ number used	Remarks
		Pentachlorophenol as a sodium salt		
(2)	0.200	2 percent solution in distilled water.	10/10	Labored respiration, depression and death in 50 minutes–8 hours.
	.125	25 percent solution in distilled water.	0/10	Transitory labored respiration and depression.
		Pentachlorophenol as a copper salt		
(3)	1.000	20 percent suspension in Tween 20.	10/10	Increased respiratory rate with severe depression and death in ½–15 hours.
	.650	20 percent suspension in Tween 20.	4/10	Same with death in 3–14 hours.
	.400	8 percent suspension in Tween 20.	4/10	Same with death in 4½–15 hours.
	.200	2 percent suspension in Tween 20.	0/10	Moderately increased respiratory rate and depression. Recovered in 10 hours.
		Pentabromophenol as a sodium salt		
(4)	0.300	3 percent solution in distilled water.	9/10	Labored respiration, salivation, depression and death in 2–15 hours.
	.200	2 percent solution in distilled water.	4/10	Do.
	.150	3 percent solution in distilled water.	0/10	Labored respiration and mild depression. Recovered in 10 hours.
		Santobrite		
(5)	0.150	1.5 percent solution in distilled water.	9/10	Increased respiratory rate, depression and death in ¾–6 hours.
	.100	1 percent solution in distilled water.	5/10	Do.
	.050	0.5 percent solution in distilled water.	0/10	Increased respiratory rate and mild depression. Recovered in 6 hours.
		2,4,6-Tribromophenol as a sodium salt		
(6)	2.500	25 percent solution in distilled water.	10/10	Severe general tremors. Occasional convulsions. Death in 10–20 minutes.
	2.000	20 percent solution in distilled water.	10/17	Severe general tremors. Died in ½–1½ hours.
	1.000	do.	3/20	Do.
		2,4,6-Triiodophenol as a sodium salt [7]		
(7)	4.000	40 percent in distilled water	10/10	Labored respiration and depression. Died in 1½–15 hours.
	2.500	do.	6/20	Do.
	1.500	30 percent in distilled water	0/20	Increased respiratory rate and depression.
		2,4,6-Triiodophenol as a sodium salt		
(8)	3.500	35 percent in distilled water	7/10	Labored respiration, depression and death in ⅓–1 hour.
	2.500	25 percent in distilled water	5/20	Labored respiration, depression and death in 1–8 hours.
	1.500	15 percent in distilled water	0/18	Labored respiration and depression

[1] Initial weights 63–155 gm.
[2] Mild to severe hemorrhagic congestion in the lungs.
[3] Mild to moderate congestion in the lungs with petechial hemorrhages. In this series 5 cc. per kilo olive oil was administered just preceding administration of the pentachlorophenol.
[4] Mild to moderate congestion in the lungs with a few petechial hemorrhages.
[5] Mild to severe hemorrhagic congestion in the lungs.
[6] Congested lungs.
[7] Supplied as the salt.
[8] Mild to severe congestion and hemorrhages in the lungs.

death or rather rapid recovery. However, although the severity of the general body tremors appeared to be of about the same order as those produced by comparable DDT poisoning, the convulsive seizures appeared to be fewer in number and somewhat less severe.

In table 2 are data on the weight changes in survivors of the acute toxicity experiments. Some weight loss occurred during the first day following a single administration of an approximate LD_{50} dose of each of the foregoing compounds, except the copper salt of pentachlorophenol in which a gain in weight occurred. Substantial gains in weight were shown by survivors in all groups during the 2 to 3 weeks following administration of a single dose.

Gross Post-Mortem Findings

Most apparent of the pathologic changes produced were in the lungs. These covered a range of mild to severe congestion and frequent petechial hemorrhages. All the compounds had the common characteristic of producing these effects in the lungs in varying degrees, somewhat proportional to the size of the dose administered. In addition, the large doses of 2,4,6-triiodophenol produced severe inflammation of the mucous membrane of the pylorus and fundus of the stomach with corrosion and hemorrhages. These were also produced by the larger doses of 2,4,6-tribromophenol but to a considerably lesser degree in severity. The smaller doses of these compounds produced only moderate inflammation of the mucosa of the stomach and intestines. Effects of the other compounds on the stomach were mild to moderate congestion of the mucosa.

Subacute Toxicity

From the data presented in table 3 the LD_{50} of Santobrite was 100 mg. per kilo, and the approximate LD_{50} of pentachlorophenol was slightly less than 150; the copper salt of pentachlorophenol, about 400; pentabromophenol, more than 250; 2,4,6-tribromophenol, less than 1,000; the sodium salt of 2,4,6-triiodophenol, less than 1,500; and 2,4,6-triiodophenol, less than 1,500.

The LD_{50} of Santobrite and the approximate LD_{50} of pentachlorophenol and pentabromophenol, when given once daily for five consecutive doses, were essentially the same as that obtained from the administration of a single dose. This is good evidence that these compounds do not produce a cumulative toxicity on repeated administration. This conclusion is also indicated by the weight changes in rats receiving five daily doses. On the maximum tolerated dose, gains in weight were obtained both during and following drug administration. The survivors of higher doses lost weight during administration but after the drugs were discontinued gained rapidly.

Evidence of some cumulative toxicity was obtained with 2,4,6-tri-

bromophenol, 2,4,6-triiodophenol, and the copper salt of pentachlorophenol. An increase of one to threefold in the LD_{50} was obtained from five daily doses of these compounds. However, with doses approximating the maximum tolerated dose, weight gains were similar to those of the pentachlorophenol and pentabromophenol. All survivors showed rapid weight gains when the drugs were omitted, and none of the animals exhibited symptoms of toxicity during this period.

Discussion

The toxicities of the compounds studied ranged in the following order: LD_{50} in mg. per kilo of Santobrite, 100; pentachlorophenol, between 125 and 200; and pentabromophenol, slightly more than 200. This compares with an LD_{50} of 150 for DDT (*3*), and 200 to 250 for chlordane (*4*).

Although little information is available on the other halogenated phenols reported in this paper, the pharmacology and toxicology of pentachlorophenol have received considerable study.

Early work on the toxic effects of pentachlorophenol was done by Bechold and Ehrlich (*5*). Recently extensive studies have been carried out by Kehoe, Deichmann, and Kitzmiller (*6*), Boyd, McGavack, Terranova, and Piccione (*7*, *8*), and Deichmann, Machle, Kitzmiller, and Thomas (*9*).

In extensive studies, Kehoe (*6*) and Deichmann and co-workers (*9*) reported the absorption, distribution, excretion, and acute and chronic toxicities of pentachlorophenol in several species of animals. Acute toxic effects included increased blood pressure, hyperglycemia and glycosuria, and hyperpyrexia and motor weakness. Lethal doses for single administration in the rabbit were 50 to 170 mg. per kilo of the free phenol and 250 mg. per kilo of the sodium salt when applied to the skin; 70 to 130 mg. per kilo of the phenol and 250–300 mg. per kilo of the salt administered orally. In the rat, the LD_{50} for single oral administration was 27 and 78 mg. per kilo for the free phenol in fuel oil and olive oil, respectively; for the sodium salt in water, it was 210 mg. per kilo.

Sodium pentachlorophenate was administered orally to 23 rabbits in doses of 3 mg. per kilo for 90 doses without signs of poisoning; the level of the drug in the blood did not increase after the fourth day. When administered to rats in the food in daily doses of 3.9 to 5 mg. per rat for 26 to 28 weeks, the only symptoms observed were lack of normal weight gains. This decreased food consumption was attributed to the unpleasant taste of the compound.

The above authors showed that approximately 70 percent of the orally administered sodium pentachlorophenate is excreted in the urine of rabbits in 24 hours, but 4 days are required for all traces to disappear from the blood (*9*).

Table 2. *Weight changes in survivors on acute toxicity experiments*

Series	Dose gm/kg	Number of animals	Number of survivors	Average weight of survivors—gm.								
				Days before administration				Days after administration				
				5th	4th	3d	0	1st	4th	5th	8th	9–23d
				Pentachlorophenol as a sodium salt								
1	0.125	10	10				94 3	93 5				125.8–20th.
				Pentachlorophenol as a copper salt								
2	0.650	10	6				84 7	89 0				160 0–21st.
	.400	10	6	91.2		96.2	112.7	115 2				120 0–9th.
	.200	10	10			81.9	95.6	98.4				147.4–20th.
				Pentabromophenol as a sodium salt								
3	0.300	10	1				138.0					175.0–17th.
	.200	10	6				127 8	125.5		131 8		162 8–18th
	.150	10		68.1			76.8	81 6	93.3			111.8–16th.
				Santobrite								
4	0.150	10	1				90 0					145 0–21st.
	.100	10	5				111.5	105 3				154.8–20th.
	.050	10	10				101 7	95 6				130.7–20th.
				2,4,6-Tribromophenol as a sodium salt								
5	2 000	17	7				106 6	99 0				145.0–23d.
	1.000	20	17			82.1	99.3	97.1				128.7–20th.

						2,4,6-Triiodophenol as a sodium salt [1]						
6	2 500	20	14	----	82.7	----	93 4	90 3	----	----	100.0	120.0–13th.
	1.500	20	20	----	----	99.5	117.6	112 4	----	----	----	158.5–20th.
						2,4,6-Triiodophenol as a sodium salt						
7	3.500	10	3	----	----	----	133 6	119 0	----	----	----	137.6–10th.
	2 500	20	15	----	----	----	112 8	103 1	----	----	----	174.8–23d.
	1 500	18	18	----	----	126 0	135 9	125 2	133.7	----	----	

[1] Supplied as the salt.

Table 3. *Subacute toxicity of halogenated derivatives of phenol in rats—oral administration*

Series	Dose gm/kg	Number animals	Death-Days						Percent mortality	Average daily weight—gm.								
										Days before administration				Days after administration				
			1st	2d	3d	4th	5th	6th–11th		5th	4th	3d	0	1st	2d	3d	4th	11th–20th
									Pentachlorophenol as a sodium salt									
(1)	0.150	10	----	1	----	----	3	2	60	----	78.0	80.5	91 9	93.9	92.0	92.1	93 7	124.5–15th.
	.100	10	----	----	----	----	----	----	0	----	67.8	69.0	77.9	80.8	83 3	87.7	89.6	116.7–16th.
									Pentachlorophenol as a copper salt									
(2)	0.650	10	4	4	----	----	----	----	80	80.1	----	----	86 2	88.8	90.5	----	----	120 0–11th.
	.400	20	9	----	2	----	----	----	55	----	----	----	91.9	91.7	87.5	90 2	----	118.5–13th.
	.200	10	----	1	1	----	----	----	20	----	79.9	82 5	96.1	99.3	97.4	99 6	101.5	135.3–15th.
									Pentabromophenol as a sodium salt									
(3)	0.250	10	----	1	----	----	----	----	10	72.9	----	77.7	97.4	99.0	100.2	99 3	103.9	127.1–15th.
	.150	10	----	----	----	----	----	----	0	----	65.5	66.9	73.8	78.5	81.0	85.3	90.2	109.6–16th.
									Santobrite									
(4)	0.100	10	5	----	----	----	----	----	50	----	----	----	113.0	102 6	97 6	107.0	----	152.8–20th.
	.050	10	----	----	----	----	----	----	0	----	----	----	105.2	96.8	94.7	99.6	----	128.9–20th.
	.025	10	----	----	----	----	----	----	0	----	----	----	79.5	82.6	86.3	87.1	89.5	108.1–16th.
									2,4,6-Tribromophenol as a sodium salt									
(5)	2.000	17	10	5	----	2	----	----	100	----	----	----	131.4	105.3	101.0	101.0	----	
	1.000	10	----	1	1	4	----	1	70	----	80.9	82.1	97 2	100.2	94.2	87 0	94.5	119 0–15th.
	.600	10	----	----	----	----	----	----	0	----	71.2	72.9	79.9	83.4	85.9	91.4	92.8	120.4–17th.

									2,4,6-Triiodophenol as a sodium salt [6]									
([7])	2.500	10	2	7	1				100	76.0		84.7	99.8	95.5				
	1.500	20		3	3	2	6	1	75			99.8	115.1	110.3	107.1	100.9	92.8	110.0–11th.
	.650	10							0		66.8	71.5	77.4	80.8	82.8	90.0	92.0	128.6–16th.
									2,4,6-Triiodophenol as a sodium salt									
([8])	2.500	15							100			105.5	113.7	104.0	89.0	96.0	88.0	
	1.500	10		1	1	1	3	1	70			125.3	133.3	125.2	126.0	121.9	112.4	138.5–11th.
	.650	10		1					10		65.9	70.1	78.8	79.4	85.8	89.6	88.2	124.7–17th.

[1] Moderate to severe congestion in the lungs with some petechial hemorrhages. Some areas of mild congestion in the lungs of survivors.
[2] Moderate to severe congestion in the lungs with hemorrhages. Some areas of mild congestion in the lungs of survivors.
[3] Petechial hemorrhages and congestion in the lungs. Some areas of mild congestion in the lungs of a few survivors on smaller doses, with most of them negative.
[4] Mild congestion in the lungs in some of survivors on largest doses. Most of survivors on smaller doses negative, with some areas of mild congestion in the lungs in a few.
[5] Congestion in the lungs with hemorrhages. Some areas of mild congestion in the lungs of survivors.
[6] Supplied as the salt.
[7] General hemorrhages in the lungs in most animals of largest doses, with severe inflammation, corrosion and hemorrhages in the mucous membrane of the pylorus and fundus of the stomach.
[8] Essentially same as 6.

Although some evidence of cumulation was shown by the rate of disappearance of pentachlorophenol from the blood, the evidence from previous work indicates that this compound is well tolerated on continued administration.

Summary and Conclusions

1. The systemic symptoms produced by toxic doses of pentachlorophenol were increased respiratory rate and amplitude, muscular weakness and collapse. In general, this syndrome was also produced by all the other related derivatives of phenol reported here except pentabromophenol. Pentabromophenol, in addition to the above symptoms, produced generalized tremors and occasional intermittent convulsions. In many respects the symptoms resembled those of DDT poisoning in the rat.

2. The acute toxicities of these compounds ranged in the following descending order: Santobrite, pentachlorophenol, pentabromophenol, the copper salt of pentachlorophenol, 2,4,6-tribromophenol, and 2,4,6-triiodophenol. Relatively no cumulative toxicity was produced by five consecutive daily doses of the first three compounds, but moderate cumulative effects were produced by the last three compounds under the same conditions.

3. Gross post-mortem findings were hemorrhages and congestion of the lungs, produced to a greater or lesser degree by all the compounds. Large doses of 2,4,6-triiodophenol produced severe inflammation, corrosion, and hemorrhages of the mucous membrane of the stomach. These were also produced to a lesser extent by 2,4,6-tribromophenol.

REFERENCES

(*1*) Nolan, M. O., and Berry, E. G.: Preliminary field trials with laboratory tested molluscacides. Pub. Health Rep. **64**: 942 (1949).
(*2*) Berry, E. G., Nolan, M. O., and Gonzales, J. O.: Field tests of molluscacides against *Australorbis glabratus* in endemic areas of schistosomiasis in Puerto Rico. Pub. Health Rep. **65**: 939 (1950).
(*3*) Smith, M. I., and Stohlman, E. F.: The pharmacologic action of 2,2 Bis (*p*-chlorophenyl)1,1,1 trichlorethane and its estimation in the tissues and body fluids. Pub. Health Rep. **59**: 984 (1944).
(*4*) Stohlman, E. F., Thorp, W. T. S., and Smith, M. I.: Toxic action of chlordan. Arch. Indust. Hyg. and Occup. Med. **1**: 13 (1950).
(*5*) Bechold, H., and Ehrlich, P.: Beziehungen zwischen Chemischer Konstitution und Dezinfektionswirking. Ztschr. f. physiol. Chem. **47**: 173 (1906).
(*6*) Kehoe, R. A., Deichmann-Gruebler, W., and Kitzmiller, K. V.: Toxic effects upon rabbits of pentachlorophenol and sodium pentachlorophenate. J. Indust. Hyg. and Toxicol. **21**: 160 (1939).
(*7*) Boyd, L. J., McGavack, T. H., Terranova, R., and Piccione, F. V.: Toxic effects following the cutaneous administration of sodium pentachlorophenate. New York Med. Coll. and Flower Hosp. Bull. **3**: 323 (1940).
(*8*) McGavack, T. H., Boyd, L. J., Piccione, F. V., and Terranova, R.: Acute and chronic intoxications with sodium pentachlorophenate in rabbits. J. Indust. Hyg. and Toxicol. **23**: 239 (1941).
(*9*) Deichmann, W., Machle, W., Kitzmiller, K. V., and Thomas, G.: Acute and chronic effects of pentachlorophenol and sodium pentachlorophenate upon experimental animals. J. Pharmacol. **76**: 104 (1942).

Effect on Calves of Prolonged Oral Administration of Three Potential Molluscacides

By Jean R. Herdt,* Ladd N. Loomis,† and M. O. Nolan*

Investigators in the Laboratory of Tropical Diseases for several years have screened chemicals in an effort to develop molluscacides for the destruction of the snail intermediate hosts of the human schistosomes. Certain compounds that were active against snails in the screening tests were tried under natural conditions in Texas (*1*) and Puerto Rico (*2*). In the Texas tests, two pentahalogenated phenols, pentabromophenol and sodium pentachlorophenate, showed promising molluscacidal activity. In Puerto Rico, these same two compounds together with other halogenated chemicals, copper pentachlorophenate, 2,4,6-tribromophenol, 2,4,6-triiodophenol and its sodium salt, proved to be very effective molluscacides.

The trials in Texas and Puerto Rico were intentionally limited because of the lack of information on the toxicity for mammals of many of the compounds which were tested as molluscacides. The experience in Puerto Rico laid the groundwork for more extensive field trials and emphasized the desirability of obtaining information on the toxicity to mammals of the more promising molluscacides.

The molluscacidal chemicals used in this work are reported on elsewhere in this issue by Stohlman, who studied their acute and chronic effects on rats. In addition, extensive investigations with experimental animals have been conducted by a number of workers over a period of years on the toxicology of pentachlorophenol and sodium pentachlorophenate, which appear to be the most promising molluscacides for use in the field. Results of these investigations have been summarized by the Monsanto Chemical Company (*3*).

In the trials in Puerto Rico (*2*), two mammalian tests were conducted before molluscacidal tests were made with sodium pentachlorophenate in flowing water. A rhesus monkey was given 200 cc. of water containing 20 parts per million of sodium pentachlorophenate without exhibiting any visible symptoms of toxicity. In another experiment a calf drank 40 gallons of water containing 20 ppm of the compound over a period of 4 days without suffering ill effects.

In the present experiment, information was sought on the effects of

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prolonged oral administration to calves of the three pentahalogenated phenols which were tried as molluscacides in Puerto Rico.

Methods and Materials

Test animals were three young bulls, weighing at the beginning of the experiments between 164 and 210 pounds and at the termination between 247 and 296.5 pounds. Since no control animal was available, the experimental animals were observed for 2 weeks (July 10 to 24) before chemical dosage was begun. Routinely, on each weekday of the 2-week observation period, pulse, respiration rate, and rectal temperature were taken, and urinalyses were made for sugar and albumin. Several blood examinations were made for cell enumerations and differential counts prior to dosage. The averages of data gathered during this period were used as the norm.

Sodium pentachlorophenate, copper pentachlorophenate, and pentabromophenol, respectively, were given orally to the calves in their drinking water. The daily dosages were well in excess of the concentration at which the chemicals are effective molluscacides. In the field, the molluscacides were applied to both standing and flowing waters at the maximum rate of 10 parts per million. It was arbitrarily decided that the optimum range of dosage in parts per million for the calves should be not less than 40 and not greater than 60. Accordingly, daily dosages were at the rate of 7.6 milligrams per kilogram of body weight, based on original body weights. After several days of less than normal water consumption by the calves, the quantities of chemicals and water were so adjusted that the chemical concentration in 10 liters of water consumed daily by each calf was maintained, as follows: for the calf given sodium pentachlorophenate, at 60 ppm; for the calf given copper pentachlorophenate, at 51 ppm; and for the calf given pentabromophenol, at 46.5 ppm.

Sodium pentachlorophenate, which is readily soluble in water, was stirred directly into the drinking water. Copper pentachlorophenate and pentabromophenol, which are almost entirely insoluble in water, were dissolved in alcohol and acetone, respectively; 70 ml. of the solvent together with 5 ml. of Tween 80 being used in every 10 liters of water administered to the calves.

The chemical dosages were given daily (including Saturday and Sunday) to the calves for 5 weeks (July 24–August 28). During this period of uninterrupted dosage, records were kept daily (excluding Saturday and Sunday) of pulse, respiration rate, and rectal temperature. Urinalyses were made daily with few exceptions when it was impossible to collect samples of urine. Blood was drawn three times a week and records were kept of red and white cell counts and differential counts.

Necropsy of the calf given copper pentachlorophenate was performed 4 days after cessation of the 5-week period of daily dosage.

Dosage of the other two calves was resumed after a lapse of 4 days and was continued an additional week for the calf given pentabromophenol and two additional weeks for the calf given sodium pentachlorophenate. Both of these calves were necropsied 4 days after termination of the additional dosage.

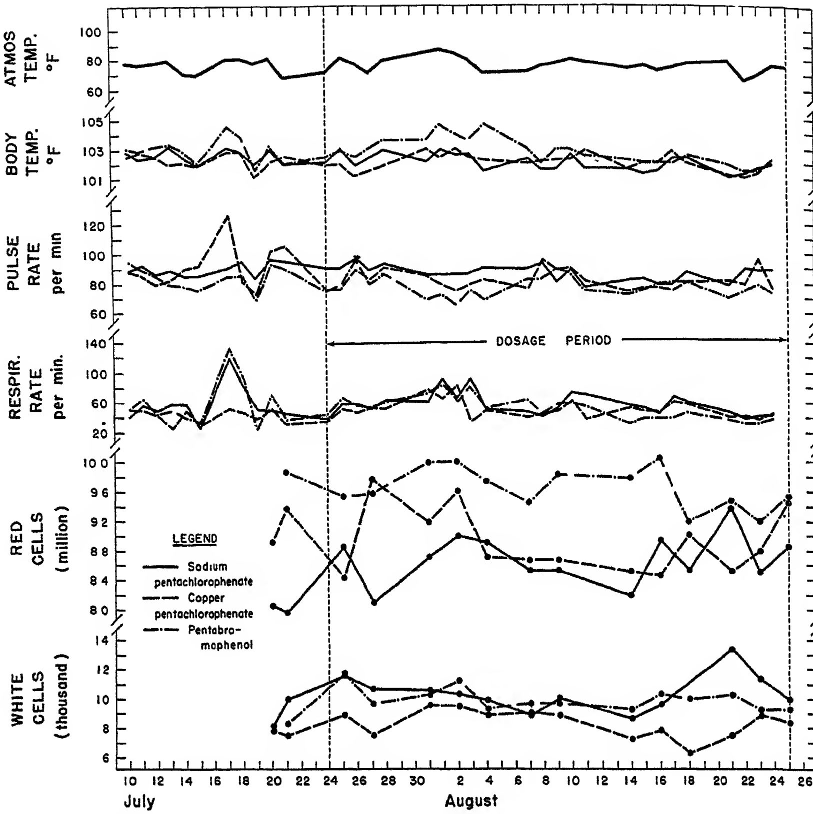
Results and Conclusions

The data on atmospheric and body temperatures, pulse and respiration rates, and blood counts are presented in the accompanying graph. Observations covering the 5-week period of uninterrupted dosage displayed no marked or significant deviations from the normal. Body temperatures of all three animals remained within normal limits during the experimental period, and although there was a slight extended depression of the body temperature of the calf given sodium pentachlorophenate after the administration of the chemical, no significant trends became evident. Pulse and respiration rates, through varying widely, fell within the normal range. On the days when the respiration rate was accelerated, it was usually true that the atmospheric temperature was somewhat above average and/or that the animals were exceptionally active and difficult to control.

The dates on which blood examinations were made are represented in the graph by heavy dots. Berkson et al. (*4*) demonstrated the tremendous variation possible in accurately performed hemocytometic measurements. In view of their work, the variations in cell enumerations in this experiment, though large, were within the bounds set by them as possible experimental error. The differential counts, not included in the graphs, were also within the expected limits of variation and showed no significant trends. The variation in the counts was large but was approximately the same for all three calves. The range of percentages for the various white cells (*a*) before dosage and (*b*) during dosage, was as follows: lymphocytes (*a*) 64–69, (*b*) 56–82; neutrophils (*a*) 20–34, (*b*) 13–35; monocytes (*a*) 1–4, (*b*) 1–11; eosinophils (*a*) 0–4, (*b*) 0–5; basophils (*a*) 0–2, (*b*) 0–2.

The urinalyses showed a positive dextrose reaction (less than 0.1 percent) rather consistently, but tests for albumin were negative throughout the course of the experiment. Prior to chemical dosage, the urinalyses were with few exceptions negative for dextrose and albumin.

Post-mortem examinations of the tissues revealed no toxic reactions to the drugs. Grossly, all three calves appeared normal with the exception of a slight enteritis, or congestion of the mucosa of the small intestine. Formalin (10 percent) and Zenkers were used as fixatives, and death to fixation of the tissues was 0 hour. Microscopically, sections of the heart, lungs, liver, spleen, thymus, adrenals, muscle, and lymph nodes showed no significant lesions. The brain of the calf given sodium pentachlorophenate showed no lesions. The



Physiological data on three calves prior to and during dosage with pentahalongenated phenols.

small intestines of all three calves showed some congestion of the capillaries of the villi but no hemorrhage was seen. A few helminth ova were noticed.

Following necropsy of the calves, the meat was hung in a well-ventilated cold room at a temperature of 37° F. for 1 week. It was then butchered and distributed to various individuals. Some of it was frozen and held for varying periods before it was cooked and eaten. The brains, liver, heart, kidneys, and thyroid glands were distributed immediately after necropsy. At least 60 persons ate the various organs and the meat. The persons who received the meat were told that the calves had been given a daily dose of a specific chemical over a period of at least 5 weeks and were asked to report upon the flavor of the meat as well as ill effects, if any, that might develop after its consumption. All reports were favorable; the meat was excellent and there were no immediate or delayed clinical symptoms.

Molluscacides are applied to natural waters in the field, as mentioned above, at a calculated dosage of 10 ppm. There is quick dissipation of the chemicals with marked dilution throughout the waters, particularly in flowing streams. All necessary precautions are taken to guard against access by humans and cattle to the waters at or near the site of application where the chemical concentration is heaviest. From a practical standpoint, it is unlikely that cattle drinking natural waters treated with chemical molluscacides would be exposed to concentrations of chemical in as high a range as 40 to 60 ppm and certainly not for any extended period of time. In view of the nontoxic reactions of the calves in the present experiment to equivalent dosages of the pentahalogenated phenols administered to them daily in their drinking water over a period of at least 5 weeks, it would appear that pentabromophenol and the copper and sodium salts of pentachlorophenol have an adequate margin of safety for use in the field as molluscacides.

Summary

The effect on cattle of repeated sublethal doses of three potential molluscacides, sodium pentachlorophenate, copper pentachlorophenate, and pentabromophenol was determined. The chemicals were given to three young bulls in their drinking water at a dosage of 7.6 mg./kg./day for at least 5 weeks. No significant deviations from normal were found in pulse, respiration rate, temperature, urinalyses, or in blood counts. Post-mortem examinations revealed no toxic manifestations. It is believed that these halogenated phenols can be used with safety as molluscacides in the field provided reasonable precautions are taken in their application.

REFERENCES

(*1*) Nolan, M. O., and Berry, E. G.: Preliminary field trials with laboratory-tested molluscacides. Pub. Health Rep. **64**: 942–949 (1949).

(*2*) Berry, E. G., Nolan, M. O., and Gonzalez, J. O.: Field tests of molluscacides against *Australorbis glabratus* in endemic areas of schistosomiasis in Puerto Rico. Pub. Health Rep. **65**: 939–950 (1950).

(*3*) Toxicology and Dermatology of Pentachlorophenol and Sodium Pentachlorophenate. Monsanto Chemical Company, 1948.

(*4*) Berkson, J., Magath, T. B., and Hurn, M.: The error of estimate of the blood cell count as made with the hemocytometer. Am. J. Physiol. **128**: 309–323 (1940).

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Double Infection of the Rat Fleas *X. cheopis* and *N. fasciatus* With *Pasteurella* and *Salmonella*

By C. R. Eskey, M.D., Frank M. Prince, B.S., Frank B. Fuller, M.S.*

During the course of experiments with plague-infected fleas, *Xenopsylla cheopis* (Roth.) and *Nosopsyllus fasciatus* (Bosc.), a number of both species accidentally became infected with *Salmonella enteritidis* (Gaertner) which was present among recently acquired white mice. As none of the secondarily infected fleas transmitted plague, although several developed complete blockage of the stomach, it was surmised that the *Salmonella* bacteria might have had some inhibitory action that interfered with plague transmission. The experimental work reported herein was undertaken to investigate the question in more detail. *Salmonella typhimurium* (Loeffler) was included in the study because it is also a widespread rodent infection.

Infection of Fleas

Fleas were infected with both plague and *Salmonella* by feeding them on white mice that had been previously inoculated subcutaneously with 0.1 cc. of a 24-hour tryptose hormone broth culture. The reaction of different mice to infection varied greatly so that it was necessary to inoculate from 5 to 10 animals at a time in order to be sure of obtaining 1 mouse suitable for infecting fleas. Only mice having a bacteremia of five or more organisms per microscopic field in smears made by snipping off the ends of the tails were utilized for infecting fleas.

The control fleas referred to in the following discussion were infected only with plague. They were kept under the same conditions and tested at the same time as most of the other infected fleas.

Determining Flea Infection

As soon as feces were observed in the bottom of each flea's test tube following its exposure to infection, the flea was transferred to a clean test tube. Then the fecal material was emulsified in a drop of bouillon and streaked on a tryptose blood agar plate. If the infecting bacteria did not appear on the first plate, a second fecal test was made before discarding the flea as uninfected. Fecal plate cultures were carried out once a week or oftener as long as the infected

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flea lived. After death, the body of each flea was triturated in a drop of bouillon, and plate cultures were prepared as described above.

Flea infection with either of the *Salmonella* organisms, whether alone or complicated by *Pasteurella pestis*, can be readily determined by the bacteriological procedures mentioned above. This is also true of uncomplicated plague infection; but when associated with salmonellosis, it is frequently impossible to prove the presence of *P. pestis* by either culture or inoculation tests. However, the positive diagnosis of plague infection of fleas does not necessarily require the demonstration of *P. pestis* by bacteriological methods because the presence of this infection can be determined by the microscopical demonstration of dark masses in the stomachs or proventriculi of live fleas when they are examined a short time after having ingested a blood meal (*1*). The *Salmonella* infections do not produce masses simulating those produced by the plague bacillus (*2*) nor do they prevent the formation of the masses which are characteristic of *P. pestis* infection. Furthermore, the mass formations of some doubly infected fleas which gave negative bacterial tests for *P. pestis* developed complete obstruction of the stomach with the typical microscopical picture of plague blockage. A few of these blocked fleas transmitted plague as illustrated in the following instance.

An *X. cheopis* female (XTP–138) was infected with *S. typhimurium* and 2 days later was fed on a plague-infected mouse. During the next 30 days, or until death of the flea, seven plague cultures were made of the feces, and then one plague culture was made of its body. Not a single *P. pestis* colony was found on any plate, but numerous colonies of *S. typhimurium* were present on all of them. At the time of the first microscopical examination on the fourth day following exposure to plague, a small dark area was observed in the blood-distended stomach. This formation had the characteristic appearance of an early plague mass. The progress of the mass was followed microscopically at 4- to 5-day intervals until the twenty-eighth day when typical plague-blockage of the stomach, due to the mass invading the proventriculus, was observed. After the development of complete obstruction of the stomach, the flea was allowed to bite three mice, two of which died of plague 5 days later so that there can be no question regarding whether or not this flea was infected with plague, although *S. typhimurium* was the only organism that could be demonstrated in cultures.

Additional evidence proving that the presence of *P. pestis* in the gastrointestinal tract of fleas may be completely obscured by an associated *Salmonella* infection was provided by the fecal tests of two *N. fasciatus* that ceased to excrete *S. typhimurium* 25 and 31 days, respectively, after the fleas had fed on a plague-infected mouse. No colonies of *P. pestis* were found on the culture plates until after the

Salmonella organisms disappeared, and then a very few colonies of plague bacilli were found on the next plate with the number becoming more numerous on the succeeding plates.

The microscopical demonstration of dark masses of the type characteristic of plague infection in the proventriculi or stomachs was the sole basis for considering 30 percent of the fleas dealt with herein as harboring both plague and *Salmonella*. The presence of the latter organisms was always proved by culture. The diagnosis of double infection in the balance of the fleas was based on finding *P. pestis* in the feces at least once, or in cultures of the dead fleas. *P. pestis* was found only once in the feces of 40 percent of the fleas, while in nine instances the bodies of the fleas proved to be plague infected when all fecal cultures gave negative results.

Two factors appear to have been responsible for the poor results obtained in attempting to prove the presence of *P. pestis* in combination with *Salmonella* bacteria by culture tests. The more important factor seemed to be the inhibiting action of salmonellosis on the multiplication of plague bacilli in the gastrointestinal tract so that very few *P. pestis* were present in the feces of fleas harboring the double infection in comparison with the number usually excreted by those infected solely with plague. Secondarily, the number of *Salmonella* organisms found on most culture plates and their rapid or profuse growth must have obscured the few plague colonies present on many cultures. The same effect was produced in broth cultures by adding 0.1 cc. of a 24-hour culture of *Salmonella* bacilli to 5 cc. of a 24-hour culture of plague. After 48 to 72 hours incubation of the mixture, *P. pestis* could no longer be found on tryptose blood agar plates.

Handling Infected Fleas

During the different stages of this study, the mean temperature at which fleas were kept varied from 71.5° to 74° F. Each flea was given an opportunity to feed on the clipped abdomen of a healthy mouse every day except Sundays and holidays. From three to five fleas were fed on the same mouse five to six times, or until one of the fleas became blocked; then the mouse was set aside for 5 days' observation. All mice that survived for 5 days were killed, autopsied, and routine cultures made from the liver, spleen, and heart's blood.

After a flea started to bite, the technician examined it at frequent intervals with a hand lens, using a pencil-point flashlight for illumination. Whenever it appeared that the host's blood was not entering the stomach normally, the flea was subjected to a microscopical examination to determine whether or not blockage of the stomach had developed. Any mouse that had been exposed to the bite of a flea found to be blocked was set aside for observation.

Transmission of Infection

By X. cheopis

According to the criteria outlined above for determining flea infection, 126 *X. cheopis* were infected with combined plague and *Salmonella* during this investigation. Of this number, 13 transmitted plague; 3, plague and *Salmonella* at the same time; 7, *S. enteritidis;* and 8, *S. typhimurium.* One blocked *X. cheopis* transmitted plague to a mouse one day and *S. typhimurium* to another the next day.

The complete details regarding the transmission of infection by *X. cheopis* are given in percentages in table 1. From these figures it will be observed that a slightly greater percentage of *X. cheopis* transmitted *S. enteritidis* than *S. typhimurium,* and that a slightly larger, but not significantly different, percentage of plague transmissions was obtained with fleas infected with *P. pestis* and *S. enteritidis* than with those infected with *P. pestis* and *S. typhimurium.* On the other hand, and contrary to expectations, the fleas infected primarily with plague or those in which plague mass formations had an opportunity to form before being infected with *Salmonella* proved to be slightly less effective vectors of plague and better transmitters of salmonellosis than the fleas secondarily infected with *P. pestis.* From the percentages listed in table 1, it might be construed that *X. cheopis* were better vectors of plague than *Salmonella* because the fleas that transmitted both infections at the same time are included with those that transmitted only plague. In reality, two more *X. cheopis* transmitted *Salmonella* than plague.

By comparing the figures in the last two lines of table 1, it will be noted that *X. cheopis* infected with *P. pestis* and *Salmonella* were relatively poor vectors of plague in comparison with those infected with only *P. pestis.* Actually *X. cheopis* females proved to be three and one-half times and males four times more likely to transmit plague

Table 1. *Transmission of infection by* X. cheopis *according to different combinations of flea infection with a comparison of the results obtained with control fleas infected with uncomplicated plague*

Nature of *X. cheopis* infection	Number *X. cheopis* infected		Percent transmitting plague or both plague and *Salmonella*		Percent transmitting *Salmonella*	
	Female	Male	Female	Male	Female	Male
Plague, then *S. enteritidis*	17	28	[1] 5.9	14.3	23.5	7.1
Plague, then *S. typhimurium*	31	12	12.9	8.5	19.4	----------
Total primary plague	48	40	10.4	12.5	20.8	5
S. enteritidis, then plague	4	4	[1] 50.0	----------	25.0	----------
S. typhimurium, then plague	13	17	[1] 30.8	----------	15.5	----------
Total secondary plague	17	21	35.3	----------	17.6	----------
Total plague and *S. enteritidis*	21	32	14.3	12.5	23.8	6.2
Total plague and *S. typhimurium*	44	29	18.2	3.4	18.2	----------
Total plague and *Salmonella*	65	61	16.8	8.2	20.0	3.3
Uncomplicated plague infected	73	32	56.9	31.3	----------	----------

[1] 1 female transmitted plague and *Salmonella* at the same time.

when their infection was not complicated with *Salmonella* than when the fleas harbored both infections. If equal numbers of male and female *X. cheopis* are infected with *P. pestis* and *Salmonella*, 12.5 percent of the total infected would be expected to transmit plague according to the results of these experiments, while 44 percent of those infected with uncomplicated plague would be vectors of the disease under the same experimental conditions.

By N. fasciatus

The results of transmission experiments with *N. fasciatus*, as itemized in table 2, were similar in many respects to those obtained with *X. cheopis*, except that *N. fasciatus* was the less effective vector. This was especially evident in the case of male *N. fasciatus*, as none of the 25 infected with both plague and *Salmonella* transmitted either infection, whereas 5 of 61 doubly infected male *X. cheopis* acted as vectors of plague and 2 as vectors of *Salmonella*. Plague transmission by *N. fasciatus* was limited to two females, both of which were infected with *S. typhimurium* and then secondarily with *P. pestis*. The failure of any of the primarily plague-infected *N. fasciatus* to transmit plague emphasizes and corroborates similar results obtained with *X. cheopis*. Furthermore, as in the case of the latter species, doubly infected *N. fasciatus* proved to be better vectors of salmonellosis than plague.

The inhibitory action of a complicating *Salmonella* infection upon the possibilities of doubly infected *N. fasciatus* transmitting plague is clearly demonstrated by the figures in table 2. According to the experimental data in this table, female *N. fasciatus* infected with *P. pestis* and *Salmonella* were only one-eighth as likely to transmit plague as females infected only with *P. pestis*. Furthermore, none of the doubly infected males acted as vectors as compared to 8 percent transmissions by males harboring uncomplicated plague. According to experimental findings, if an equal number of female and male

Table 2. *Transmission of infection by* N. fasciatus *according to different combinations of flea infection with a comparison of the results obtained with control fleas infected with uncomplicated plague*

Nature of *N. fasciatus* infection	Number *N. fasciatus* infected		Percent transmitting plague or plague and *Salmonella*		Percent transmitting only *Salmonella*	
	Female	Male	Female	Male	Female	Male
Plague, then *S. enteritidis*	9	4	----------	----------	22.2	----------
Plague, then *S. typhimurium*	17	7	----------	----------	11.8	----------
Total primary plague	26	11	----------	----------	15.4	----------
S. typhimurium, then plague	25	14	[1] 8	----------	4	----------
Total plague and *S. typhimurium*	42	21	4.8	----------	7.1	----------
Total plague and *Salmonella*	51	25	3.9	----------	9.8	----------
Uncomplicated plague	15	13	33.3	7.7	----------	----------

[1] 1 female transmitted both plague and *Salmonella* at the same time.

N. fasciatus were infected with both *P. pestis* and *Salmonella*, only 2 out of 100 could be expected to transmit plague, or a vector potential too low for the continued propagation of the disease among a rodent population. This inhibitory effect of a *Salmonella* infection upon plague transmission by *N. fasciatus* was approximately six times greater than noted above for *X. cheopis*.

Stomach Blockage and Transmission of Infection

Blockage or obstruction of the stomach due to mass formations in the proventriculus or esophagus was present at the time all doubly infected *X. cheopis* and *N. fasciatus* transmitted plague to exposed mice. All *X. cheopis* were also blocked at the time they transmitted salmonellosis, but no evidence of obstructing masses was observed for three *N. fasciatus* that transmitted this infection. The mechanism involved in the transmission of *Salmonella* by these three *N. fasciatus* was probably the same as that involved in its transmission by fleas, infected solely with *Salmonella* organisms (*2*), which acted as vectors without the formation of visible blocking masses.

Since blockage appears to be essential for doubly infected fleas to act as vectors of plague, it is evident from a comparison of the figures in table 3 that a complicating *Salmonella* infection tends to reduce the possibilities of plague transmission by interfering with mass formations producing obstruction of the stomach. This table has been computed for females only because of the difference in the number of each sex tested and because females proved to be much more efficient vectors of infection than males. The most noticeable feature in table 3 is the greater deterrent effect of a complicating *Salmonella* infection upon blockage of *N. fasciatus* than upon *X. cheopis*. In fact, the presence of *Salmonella* organisms reduced blockage of *N. fasciatus* females to one-fourth the percentage of those infected only with plague, while blockage of doubly infected *X. cheopis* females was much less affected, being reduced only 15 and 30 percent, respectively,

Table 3. *Relation of blockage of the stomach to plague transmission by female* X. cheopis *and* N. fasciatus

	Nature of female infection					
	X. cheopis females			*N. fasciatus* females		
	Plague then *Salmonella*	*Salmonella* then plague	Plague only controls	Plague then *Salmonella*	*Salmonella* then plague	Plague only controls
Number infected	48	17	73	26	25	15
Number that became blocked	34	10	61	4	4	9
Percent blocked	70.8	58.8	83.6	15.4	16.0	60.0
Percent blocked transmitting plague	14.7	60.0	68.9	----------	50.0	55.5

for those females secondarily and primarily infected with *Salmonella* as compared to the controls.

This marked difference in the effects of *Salmonella* infection upon blockage of the two varieties of fleas is probably due to the difference in the mechanism involved in producing obstruction of the stomach in the majority of each species. In the case of *N. fasciatus*, as well as most other species of fleas, plague masses commonly originate in the stomach so that blockage depends upon the mass formations invading the proventriculi secondarily which may not occur for several weeks or months. On the other hand, plague masses tend to originate and to mature in the proventriculi of most *X. cheopis*, thus, in comparison with stomach masses, insuring blockage of a greater percentage of fleas and shortening the period between infection and obstruction. Therefore, it would appear that mass formations developing in the stomachs of *N. fasciatus* would be more exposed to the effects of a complicating *Salmonella* infection which, as shown above, tends to inhibit blockage of doubly infected females of both species.

The restraining action upon blockage by a complicating *Salmonella* infection appears to have been chiefly responsible for the low plague vector efficiency of all doubly infected *N. fasciatus* females and for *X. cheopis* females that were secondarily infected with *P. pestis*. But, the failure of most primarily plague-infected *X. cheopis* females to transmit this infection did not depend as much upon the percentage that developed obstruction of the stomach as upon the innocuousness of their blocked bites. Therefore, it may be stated that a complicating *Salmonella* infection reduces the effectiveness of doubly infected *X. cheopis* and *N. fasciatus* to act as transmitting agents of plague by interfering with blockage of the stomach and by rendering many blocked bites harmless in regard to plague transmission.

Salmonella-Infected Fleas Collected

No reference could be found in the literature regarding the *Salmonella* infection of fleas collected from either domestic rats or wild rodents. However, during the past year the Western Communicable Disease Center Laboratory, in the course of testing fleas for plague infection by guinea pig inoculation, found that 10 specimens of fleas from wild rodents and 7 from domestic rats were infected with *Salmonella* as summarized in table 4. More specimens of fleas infected with *S. typhimurium* than *S. enteritidis* were obtained from both wild rodents and domestic rats. In fact, only one flea specimen collected from wild animals, namely chipmunks, was infected with *S. enteritidis*. All bacteriological identifications were verified by the Communicable Disease Center Enteric Laboratory, Chamblee, Ga.

All test guinea pigs died from the effects of the *Salmonella* infections in 3 to 7 days, except one that was inoculated with *S. enteritidis*-

Table 4. *Summary of data concerning the demonstration of rodent flea infection with salmonellosis*

Locality where obtained	Fleas inoculated	Rodent source of fleas	
		Number	Species
S. typhimurium			
New Mexico, San Juan County	46	6	Prairie dogs, *C. gunnisoni.*
Montana, Richland County	61	35	Prairie dogs, *C. ludovicianus.*
Wyoming, Fremont County	19	11	Prairie dogs, *C. leucurus.*
Idaho, Caribou County	565	12	Marmots, *M. flaviventris.*
New Mexico, Rio Arriba County	61	103	Deer mice, *P. maniculatus.*
New Mexico, McKinley County	12	79	Do.
Montana, McCone County	17	25	Do.
Wyoming, Lincoln County	9	19	Do.
Kansas, Wichita County	1	16	Harvest mice, *R. megalotis.*
California, San Francisco	6	4	Norway rats, *R. norvegicus.*
Do	6	8	Do.
Do	75	15	Do.
Washington, Tacoma	48	2	Do.
Do	26	30	Roof rats, *R. rattus.*
S. enteritidis			
Wyoming, Washakie County	5	7	Chipmunks, *E. minimus.*
New Mexico, Bernalillo County	310	116	Norway rats, *R. norvegicus.*
Washington, Seattle	9	1	Do.

infected fleas from chipmunks, so that there is no question regarding the high degree of virulence of this infection among wild and domestic rodents. Furthermore, it would seem that epizootics of this disease are widely disseminated among rodents in the western part of the United States.

Discussion

It is evident from the foregoing report that the two species of domestic rat fleas, *X. cheopis* and *N. fasciatus*, can be readily infected with *P. pestis* and with *S. typhimurium* or *S. enteritidis*. A few ground squirrel fleas, *Diamanus montanus*, have been infected with plague and *Salmonella* so that it may be assumed that most other flea species are susceptible to double infection with these bacteria.

Fleas infected with both *P. pestis* and *Salmonella* organisms proved to be slightly better vectors of salmonellosis than plague, but in comparison to controls or those infected only with *P. pestis*, the doubly infected fleas were relatively poor transmitting agents of plague. For instance, according to the experimental results, only 12.5 percent of an equal number of doubly infected *X. cheopis* males and females are likely to transmit plague as compared to 44 percent transmissions by controls. The inhibiting action of the complicating *Salmonella* infection upon plague transmission by *N. fasciatus* was even greater than in the case of *X. cheopis*. None of 25 doubly infected *N. fasciatus* males transmitted plague, while transmissions by females were limited to 4 percent as compared to 33 percent of the controls. From these findings it may be assumed that a complicating *Salmonella* infection is likely to reduce the vector efficiency of doubly infected *X. cheopis* to such a degree that such fleas will be incapable of propa-

gating a plague epizootic and may not be able to keep the disease alive in an enzootic form except under very favorable conditions. On the other hand, the inhibiting effects of a *Salmonella* infection upon *N. fasciatus* was so great that it seems unlikely that doubly infected fleas of this species would be able to keep rodent plague infection active under any circumstances.

The wide distribution of rodent salmonellosis is evident from the fact that infected fleas were obtained from 7 species of wild rodents which were shot or trapped in 10 counties of 5 Western States and from 2 species of domestic rats that were trapped in 3 Pacific Coast ports and a hog ranch near Albuquerque, N. Mex. All fleas from the last source were chicken fleas, *Echidnophaga gallinacea.*

The collection of *Salmonella*-infected fleas from domestic rats and several species of wild rodents, which were shot or trapped in widely scattered areas of the western part of the United States, indicates that epizootics of salmonellosis must be rather common in urban and rural areas. Furthermore, this evidence proves that fleas may be naturally infected with either *S. typhimurium* or *S. enteritidis.* Therefore, although there is no definite evidence to support the theory, it may be assumed that should epizootics of plague and salmonellosis involve the rodents of the same rural area or urban community, the course of the plague epizootic might be adversely affected by the concurrent salmonellosis.

Summary

This investigation demonstrated that the domestic rat fleas, *X. cheopis* and *N. fasciatus*, can be infected with combined plague and *Salmonella*, and that such fleas may transmit either infection. However, the ability of these doubly infected fleas to transmit plague was greatly inhibited by the complicating *Salmonella* infection.

Naturally *Salmonella*-infected fleas were collected from domestic rats and several species of wild rodents in many different areas in the Western States, thus demonstrating the wide dissemination of salmonellosis among rodents. It is possible that *Salmonella* epizootics may sometimes modify the course of plague among a rodent population subjected to both infections.

REFERENCES

(1) Eskey, C. R., and Haas, V. H.: Plague in the western part of the United States. Public Health Bulletin No. 254. U. S. Government Printing Office, Washington, D. C., 1940.

(2) Eskey, C. R., Prince, F. M., and Fuller, F. B.: Transmission of *Salmonella enteritidis* by the rat fleas. *Xenopsylla cheopis* and *Nosopsyllus fasciatus.* Pub. Health Rep. 64: 933 (1949).

Two Provisional *Shigella boydii* Serotypes

By W. H. Ewing and M. W. Taylor*

Provisional *Shigella boydii* 10

Szturm, Piéchaud, and Neél (*12*) described two cultures that were isolated from acute cases of bacillary dysentery in Madagascar. These cultures, D15 and D21, presented biochemical characteristics similar to those given by *Shigella boydii* types but antigenically were unrelated to previously described shigellae. It was concluded that the two cultures comprised a new *S. boydii* serotype. The writers obtained cultures D15 and D21 for study and comparison with several undescribed *Shigella* and *Shigella*-like cultures in our collection. It was found that cultures D15 and D21 biochemically and serologically were similar to two microorganisms, cultures 430 and 650, that were isolated by the senior author from cases of bacillary dysentery in Italy during 1944.

The biochemical reactions obtained with cultures D15, D21, 430, and 650 are as follows: glucose, mannitol, and arabinose are fermented without gas formation within 24 hours, and acid is produced from dulcitol after 1 to 4 days' incubation. The cultures vary in their ability to utilize maltose. Lactose, sucrose, rhamnose, salicin, adonitol, and inositol are not utilized. The microorganisms are nonmotile, do not hydrolyse urea, do not form acetylmethylcarbinol, do not grow on Simmons' citrate agar, do not utilize citrate in the medium of Christensen (*2*), and do not form indol. The methyl red test is positive.

Cultures D15 and D21 of Szturm et al. (*12*) are agglutinated to the titer of antiserums prepared with cultures 430 and 650. Conversely, cultures D15, D21, 430, and 650 reacted similarly in an antiserum prepared with a heated (100° C., 2½ hours) broth suspension of culture D21. The results of reciprocal agglutinin absorption tests indicate that the heat-stable somatic antigens of these four cultures are identical. Results representative of these tests are given in table 1. The cultures that comprise this type are unrelated, in any significant way, to described *Shigella* types. However, the serotype is related to provisional *Shigella boydii* 11, described below.

Studies on the relationship of provisional *S. boydii* 10 cultures to other members of the family Enterobacteriaceae revealed that the O antigens of provisional *S. boydii* 10 cultures are related to those of

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Table 1. *The antigenic relationship of provisional* S. boydii *10 cultures and* E. Coli *O group 105*

O antigen suspensions (100° C., 1 hr.)	O antiserums						
	D21			430		*E. coli* 0105	
	Unabsorbed	Absorbed by 430	Absorbed by *E. coli* 0105	Unabsorbed	Absorbed by D21	Unabsorbed	Absorbed by D21
D21 (Szturm et al)	[1] 20,480	[2] 0	5,120	20,480	0	1,280	0
430 (Italy)	5,120	0	2,560	20,480	0	1,280	0
E. coli 0105	5,120	0	0	2,560	0	20,480	10,240

[1] Figures indicate the reciprocal of the highest dilution that gave visible agglutination.
[2] 0 indicates negative in a dilution of 1:40 and higher.

Escherichia coli O group 0105 [1] but are not identical with them (table 1).

Provisional *Shigella boydii* 11

Culture 34 represents the first culture of the second provisional *S. boydii* type that was seen by the writers. It was isolated by the senior author from a case of bacillary dysentery in Oran, Algeria, in 1943. Culture 732 was isolated by Dr. A. H. Stock in Casablanca during 1943. Culture 6108/50 was recovered from a case of dysentery, complicated by a *Giardia* infestation, at the Public Health Service Outpatient Clinic, Washington, D. C., and was sent to this laboratory for examination. The patient from whom culture 6108/50 was isolated became ill upon his return to the United States from South and Central America. Dr. Rebelo isolated culture 606/51 in Mexico City and sent it to this laboratory for identification. The history of this culture is not available.

The biochemical reactions of cultures 34, 732, 6108/50, and 606/51 are similar to those of cultures D15, etc. except that dulcitol is not utilized and indol is formed.

Cultures of this serotype are related to *Shigella boydii* 4 (P274) and to Alkalescens-Dispar O group 1 (*Shigella alkalescens*). The factor that is common to these three types is the factor that relates *S. boydii* 4 and Alkalescens-Dispar (A–D) 01 cultures. Cultures of provisional *S. boydii* 11 no longer react in antiserum for *S. boydii* 4 that is absorbed with a suspension of A–D 01 nor in antiserum for A–D 01 that is absorbed with a culture of *S. boydii* 4. Provisional *S. boydii* 11 cultures contain an O antigen in common with provisional *S. boydii* 10 cultures, but each of these serotypes contains a specific antigen that is not shared (table 2). This relationship may be explained by use of the arbitrary formula, *a b c*. The two serotypes

[1] For studies on serological typing of *Escherichia coli* cultures see references *4, 7–11*.

Table 2. *The relationship of provisional* S. boydii *10 and provisional* S. boydii *11 cultures*

O antigen suspensions (100° C., 1 hour)	O antiserums			
	Provisional *S. boydii* 10 (430)		Provisional *S. boydii* 11 (34)	
	Unabsorbed	Absorbed by 34	Unabsorbed	Absorbed by 430
Provisional *S. boydii* 10 (430)	20, 480	5, 120	10, 240	0
Provisional *S. boydii* 11 (34)	1, 280	0	20, 240	2, 560

contain the antigen *a* in common, and each type contains an unrelated antigen which may be designated *b* in provisional *S. boydii* 10, and *c* in provisional *S. boydii* 11 cultures. To separate these two serotypes by means of slide tests, it is necessary to employ antiserums that are cross absorbed. Cultures of provisional *S. boydii* 11 are not related significantly to other known shigellae. Provisional *S. boydii* 11 cultures contain heat-stable somatic antigens that are identical with those of *E. coli* O group 105, as demonstrated by reciprocal agglutinin absorption tests (table 3).

Table 3. *The relationship of provisional* S. boydii *11 and* E. coli *O group 105*

O antigen suspensions (100° C., 1 hour)	O antiserums			
	Provisional *S. boydii* 11 (732)		*E. coli* 0105	
	Unabsorbed	Absorbed by *E. coli* 0105	Unabsorbed	Absorbed by provisional *S. boydii* 11 (732)
Provisional *S. boydii* 11 (732)	5, 120	0	5, 120	0
E. coli 0105	5, 120	0	20, 480	0

Discussion

The results of our studies confirm and extend those of Szturm et al. (*12*). Cultures D15, D21, 430, and 650 are unrelated to known shigellae and constitute a new serotype. Since the cultures utilize mannitol but bear no serological relationship to *Shigella flexneri* serotypes, it is necessary to place them in group C, the *Shigella boydii* group,[2] as suggested by Szturm and associates (*12*). Therefore, we propose to designate this new serotype provisional *Shigella boydii* 10. Pending confirmation and agreement of other workers, this serotype

[2] Group C of the *Shigella* schema consists of *Shigella boydii* 1 through 7 (*5*). Type 112 described by Cox and Wallace (*3*) was accepted by the Shigella Commission of the Enterobacteriaceae Subcommittee as provisional *Shigella boydii* 8, and type 1296/7 (*1*) was accepted as provisional *Shigella boydii* 9 (*6*).

will be added to the *Shigella* schema when the report of the Enterobacteriaceae Subcommittee of the International Congress for Microbiology is made on the occasion of the Congress in Rome in 1953.

Although cultures 34, 732, 6108/50, and 606/51 are related to provisional *S. boydii* 10 cultures, it is thought advisable to refer to them as provisional *S. boydii* 11 rather than to place them under the provisional *S. boydii* 10 designation. Besides the fact that the two serotypes contain a specific antigen, it seems inadvisable to place both indol negative and indol positive strains within the same type designation.

Although these new *Shigella* types do not appear to be common, they have been found in widely separated parts of the world. The cultures mentioned above originated in Madagascar, North Africa, Italy, Mexico, and South or Central America. Szturm-Rugebensten (*13*) reports that three cultures which resemble D15 and D21 (provisional *S. boydii* 10) recently were isolated in Hanoi, Indochina. It seems probable that the new types will be recognized in other parts of the world as well.

Summary

Two additional *Shigella* serotypes are described. These are provisional *Shigella boydii* 10 (Szturm et al. *12*) and provisional *S. boydii* 11. The two serotypes are related but each contains a specific antigen. Cultures of provisional *S. boydii* 10 do not produce indol while provisional *S. boydii* 11 cultures do form this substance.

The heat-stable somatic antigens of provisional *S. boydii* 10 are related to those of *Escherichia coli* O group 105 but are not identical with them. The O antigens of provisional *S. boydii* 11 cultures are identical with those of *E. coli* 0105 as demonstrated by reciprocal absorption tests.

Addendum

After this paper was submitted for publication, the three Hanoi cultures, mentioned in the discussion, were received from S. Szturm. All three are provisional *Shigella boydii* 11 cultures. S. Szturm informs us that the Hanoi cultures were grouped with D15 (provisional *Shigella boydii* 10) in a paper presented at the June 1951 meeting of the Societé francaise de Microbiologie.

Additional cultures of both provisional *S. boydii* 10 and 11 were isolated in Belgian Congo by Dr. Vandepitte, and Roja Sapiro has isolated cultures of provisional *S. boydii* 10 at Haifa.

REFERENCES

(*1*) Boyd, J. S. K.: Laboratory findings in clinical dysentery in the Middle East Force between August 1940 and June 1943. J. Path. and Bact. **58:** 237–241 (1946).

(2) Christensen, W. B.: Hydrogen sulfide production and citrate utilization in the differentiation of enteric pathogens and the coliform bacteria. Research Bull. (Weld Co., Colo. Health Dept.) **1**: 3–16 (1949).
(3) Cox, C. D., and Wallace, G. I.: A study of *Shigella* isolated in India and Burma, with special reference to two previously undescribed serotypes. J. Immunol. **60**: 465–473 (1948).
(4) Ewertsen, H. W.: Dyreexperimentelle undersøgelser over Colibacillernes Patogenitet og Effekten af Coliserum (English summary). Nyt Nordisk Forlag, Arnold Busck, Copenhagen, 1946, 217 pp.
(5) Ewing, W. H.: *Shigella* nomenclature. J. Bact. **57**: 633–638 (1949).
(6) Ewing, W. H., Taylor, M. W., and Hucks, M. C.: Provisional *Shigella boydii* 9. (In press 1951.)
(7) Kauffmann, F.: Zur Serologie der Coli-Gruppe. Acta path. et microbiol. Scandinav. **21**: 20–45 (1944).
(8) Kauffmann, F.: The serology of the *coli* group. J. Immunol. **57**: 71–100 (1947).
(9) Kauffmann, F.: On the classification of the Enterobacteriaceae. Acta path. et microbiol. Scandinav. **26**: 879–881 (1949).
(10) Knipschildt, H. E.: Undersøgelser over Coligruppens Serologi (English summary). Nyt Nordisk Forlag, Arnold Busck, Copenhagen, 1945, 178 pp.
(11) Vahlne, G.: Serological typing of the colon bacteria. Acta path. et microbiol. Scandinav. Supp. 62 (1945). Håkan Ohlssons Bokbryckeri, Lund.
(12) Szturm, S., Piéchaud, M., and Neél, R.: Un nouveau type antigenique de *Shigella boydii*. Ann. Institute Pasteur 78: 146–147 (1950).
(13) Szturm-Rugebensten, S.: Personal communication, 1951.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended, September 22, 1951

Poliomyelitis

The total reported cases of poliomyelitis in the Nation was 1,746 for the current week, compared with 1,797 for last week. Since the seasonal low week for the current year, a cumulative total of 17,889 cases has been reported, compared with 18,407 for the corresponding period in 1950. The cumulative total for the calendar year is 19,101, compared with 19,538 for the 1950 calendar year.

Of the nine geographic divisions, six decreased from the preceding week and three increased for the same period. The East North Central increased from 447 last week to 486 for the current week; the East South Central, from 110 to 154; and the Pacific, from 194 to 219.

Wisconsin reported that cases of poliomyelitis increased from 100 last week to 151 for the current week. Other States reporting more than 100 cases for the week were: California 172, New York 121, and Illinois 116.

States reporting the largest decreases were: Colorado, from 67 to 41; Missouri, from 79 to 55; and Utah, from 49 to 26.

A summary of the 241 cases of poliomyelitis reported in Arkansas between January 1 and September 1 shows that 130, or 54 percent, occurred in 3 counties. These cases were distributed by age as follows: 109 were under 5 years, 52 were 5 to 9, 32 were 10 to 14, and 48 were 15 years of age and over. There have been 10 deaths. The proportion of cases in the older age group, 19.9 percent, is more than twice that for 1949 when 9.3 percent were 15 years of age and over.

Malaria

For the current week, 57 cases of malaria in civilians and 208 cases in the military were reported. The largest civilian totals were reported in Georgia, 16, and Wisconsin, 23. The largest military totals were reported in Maryland, 20, Massachusetts, 28, Pennsylvania, 25, South Carolina, 47, and Texas, 21.

Epidemiological Reports

Erythema Contagiosum

Dr. C. C. Kuehn, Louisiana Department of Health, reports the occurrence of several cases of a disease entity resembling erythema contagiosum in and around Baton Rouge. Children 3 to 6 years of age are principally affected.

Keratoconjunctivitis

Dr. A. A. Jenkins, Utah Department of Health, has reported an outbreak of keratoconjunctivitis occurring mainly in a school for Indians located in Box Elder County. An ophthalmologist stated that a few cases were seen in the spring of 1951, but the outbreak, explosive in character, started during the last week of August and continued into September. It is now subsiding. A total of 750 cases has been reported from the school. Bilateral nonpurulent conjunctivitis was observed in most cases, and enlargement of preauricular lymph nodes was seen in a few instances. Acute and convalescent phase blood serum specimens are being studied.

Gastroenteritis

Dr. R. F. Feemster, Massachusetts Department of Health, has reported five cases of food poisoning in persons eating baked ham sandwiches in a local restaurant on September 4. All become violently ill with vomiting, diarrhea, and chills 3 to 4 hours after eating the ham.

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Sept. 22, 1951	Sept. 23, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	-------	2	-------	(1)	(1)	(1)	(1)	46	32	40
Diphtheria (055)	101	136	186	27th	613	890	1,540	2,621	4,018	6,150
Encephalitis, acute infectious (082)	22	24	23	(1)	(1)	(1)	(1)	766	679	480
Influenza (480–483)	307	548	528	30th	2,289	2,939	2,825	118,344	141,703	131,027
Measles (085)	815	534	539	35th	2,561	1,858	1,649	471,472	289,729	553,666
Meningitis, meningococcal (057.0)	50	51	48	37th	50	51	48	3,111	2,850	2,686
Pneumonia (490–493)	413	674	(2)	(1)	(1)	(1)	(1)	48,261	64,167	(2)
Poliomyelitis, acute (080)	1,746	2,169	1,606	11th	[3] 17,889	18,407	17,296	[3] 19,101	19,538	17,646
Rocky Mountain spotted fever (104)	6	14	11	(1)	(1)	(1)	(1)	289	420	495
Scarlet fever (050)[4]	390	456	482	32d	1,694	1,857	2,357	55,080	42,027	59,446
Smallpox (084)	-------	-------	1	35th	-------	-------	2	11	26	51
Tularemia (059)	12	13	17	(1)	(1)	(1)	(1)	506	721	748
Typhoid and paratyphoid fever (040, 041)[5]	96	82	104	11th	1,826	2,078	2,364	2,261	2,588	2,849
Whooping cough (056)	1,082	1,792	1,792	39th	[6] 74,390	117,101	100,165	[6] 52,788	95,565	74,147

[1] Not computed. [2] Data not available. [3] Addition: Iowa, 22 cases, delayed report—not allocated. [4] Including cases reported as streptococcal sore throat. [5] Including cases reported as salmonellosis. [6] Addition: Utah, week ended September 15, 3 cases.

The ham was baked at the restaurant after being deboned. Specimens showed presence of *Staphylococcus aureus*.

Dr. D. S. Fleming, Minnesota Department of Health, reports 19 of 33 persons partaking of a picnic supper became ill 12 hours later with diarrhea. A nonhemolytic streptococcus found in hamburger and a barbecue sauce was the only evidence found in specimens of food.

Dr. R. M. Albrecht, New York State Department of Health, has reported two mild outbreaks of gastroenteritis in a camp in which unsatisfactorily chlorinated lake water was regarded as the source of infection. During periods of peak demand inadequate contact with chlorine was shown to exist. In another outbreak in a resort hotel, it was found that food handling practices were poor. Dishwashing was poorly performed, and refrigeration facilities were not properly used.

Dr. W. L. Halverson, California Department of Public Health, reports seven cases of food poisoning after a roast turkey dinner. The illness followed 8 to 15 hours after eating the turkey and dressing. The laboratory reported negative results of examination of the roast turkey, but hemolytic *Staphylococcus aureus* was found in the turkey dressing.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Sept. 22, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**101**	**22**	**307**	**815**	**50**	**413**	**1,746**
New England	**1**	**1**	**3**	**107**	**4**	**18**	**32**
Maine	-	-	-	27	1	5	2
New Hampshire	-	-	3	3	-	1	4
Vermont	-	-	-	11	-	-	2
Massachusetts	1	1	-	38	2	-	9
Rhode Island	-	-	-	8	-	-	1
Connecticut	-	-	-	20	1	12	14
Middle Atlantic	**6**	**4**	**2**	**184**	**12**	**53**	**226**
New York	5	2	(1)	110	9	-	121
New Jersey	-	2	2	46	1	18	41
Pennsylvania	1	-	-	28	2	35	64
East North Central	**6**	**2**	-	**185**	**6**	**53**	**486**
Ohio	3	-	-	34	2	-	89
Indiana	1	-	-	4	-	4	31
Illinois	-	1	-	54	2	31	116
Michigan	1	1	-	34	2	18	99
Wisconsin	1	-	-	59	-	-	151
West North Central	**4**	**3**	**3**	**38**	**3**	**20**	**238**
Minnesota	-	-	1	10	1	9	41
Iowa	-	2	-	1	-	-	34
Missouri	1	1	1	8	-	-	55
North Dakota	-	-	-	6	-	7	5
South Dakota	1	-	-	2	-	-	7
Nebraska	2	-	-	1	-	-	38
Kansas	-	-	1	10	2	4	58
South Atlantic	**41**	-	**103**	**68**	**7**	**46**	**77**
Delaware	-	-	-	-	-	-	-
Maryland	1	-	1	29	-	9	4
District of Columbia	1	-	-	2	-	16	1
Virginia	5	-	79	7	2	8	20
West Virginia	2	-	-	9	1	-	9
North Carolina	17	-	-	9	3	-	11
South Carolina	10	-	4	1	1	5	4
Georgia	2	-	19	4	-	8	24
Florida	3	-	-	7	-	-	4
East South Central	**32**	**6**	**3**	**30**	**8**	**20**	**154**
Kentucky	6	-	-	9	1	4	12
Tennessee	14	2	-	3	2	-	59
Alabama	8	2	-	12	3	5	24
Mississippi	4	2	3	6	2	11	59
West South Central	**9**	**4**	**75**	**30**	**4**	**136**	**177**
Arkansas	1	-	50	2	-	23	24
Louisiana	-	-	5	-	-	23	47
Oklahoma	2	-	20	2	1	4	33
Texas	6	4	-	26	3	86	73
Mountain	**2**	**1**	**94**	**63**	**2**	**36**	**137**
Montana	2	1	10	32	2	-	28
Idaho	-	-	-	5	-	-	6
Wyoming	-	-	-	1	-	-	9
Colorado	-	-	-	4	-	11	41
New Mexico	-	-	-	8	-	9	8
Arizona	-	-	84	3	-	16	14
Utah	-	-	-	10	-	-	26
Nevada	-	-	-	-	-	-	5
Pacific	-	**1**	**24**	**110**	**4**	**31**	**219**
Washington	-	-	7	4	-	-	30
Oregon	-	-	9	18	1	13	17
California	-	1	8	88	3	18	172
Alaska	-	-	-	-	-	-	5
Hawaii	-	-	-	33	-	-	-

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Sept. 22, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	6	390		12	96	1,082	104
New England		24			5	93	
Maine						7	
New Hampshire		2				7	
Vermont						2	
Massachusetts		17			5	56	
Rhode Island		2					
Connecticut		3				21	
Middle Atlantic	1	55			6	195	18
New York	1	21				107	10
New Jersey		2				34	
Pennsylvania		32			6	54	8
East North Central		83		1	6	234	13
Ohio		29			1	55	2
Indiana		6				11	6
Illinois		12		1	5	43	2
Michigan		22				71	3
Wisconsin		14				54	
West North Central		27			7	52	14
Minnesota		13				4	7
Iowa		6			2	7	2
Missouri		2			4	14	4
North Dakota						3	
South Dakota		1				1	
Nebraska						3	1
Kansas		5			1	20	
South Atlantic	1	49		4	12	76	12
Delaware							
Maryland	1	5		2		6	
District of Columbia		2				2	
Virginia		13		1	2	4	2
West Virginia		10			4	27	2
North Carolina		13		1	1	11	
South Carolina		3					5
Georgia		2			4	6	3
Florida		1			1	20	
East South Central	2	45		2	14	55	19
Kentucky		21			4	8	4
Tennessee	1	12			4	34	4
Alabama		9			3	4	5
Mississippi	1	3		2	3	9	6
West South Central	1	15		3	12	239	26
Arkansas	1	7		2	3	23	8
Louisiana		2			5	4	
Oklahoma		2			1	7	1
Texas		4		1	3	205	17
Mountain	1	7		2	4	43	2
Montana						3	
Idaho		1				3	
Wyoming		1		1		4	
Colorado		4			2	14	
New Mexico					2	2	2
Arizona						13	
Utah	1	1		1		4	
Nevada							
Pacific		85			30	95	
Washington		3				14	
Oregon		10			1	6	
California		72			29	75	
Alaska					1	1	
Hawaii		1					

[1] Including cases reported as streptococcal sore throat. [2] Including cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Sept. 8, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	11					4	6				1
Chickenpox	203			1		26	77	13	16	33	37
Diphtheria	5					4			1		
Dysentery:											
Amebic	1								1		
Bacillary	15					1	2				12
Encephalitis, infectious	1								1		
German measles	55			1		5	17		12	7	13
Influenza	17			17							
Measles	291	16		65	2	43	34	8	21	52	50
Meningitis, meningococcal	9			1		1		2	4		1
Mumps	208	2		1		11	96	17	36	14	31
Poliomyelitis	149			27	4	19	85	1	5	4	4
Scarlet fever	101			1		22	11	18	14	11	24
Tuberculosis (all forms)	163	6		1	9	61	17	11	6	31	21
Typhoid and paratyphoid fever	10					7	1			1	1
Venereal diseases:											
Gonorrhea	217	5		4	4	47	45	19	17	34	42
Syphilis	84	2		7	3	47	10	2	2	2	9
Primary	3					1	1		1		
Secondary	8					6				2	
Other	73	2		7	3	40	9	2	1		9
Whooping cough	211					50	96	8	13	28	16

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Cholera

Burma. For the week ended September 1, 1951, 176 cases (97 deaths) of cholera were reported in the country as a whole. During August and the first 2 weeks of September, 37 cases of cholera, 10 of which were for the week ended September 15, were reported in the seaport of Tavoy.

India. A sharp increase in the incidence of cholera was reported in two seaports for the week ended September 8, 1951, but for the following week a decrease was noted. The decrease was as follows: Madras, from 140 cases to 115, and Calcutta, 66 to 42.

Smallpox

Cameroons (*French*). During the period August 21–31, 9 cases of smallpox were reported as compared with 33 for the previous 10-day period.

Ceylon. The recent outbreak of smallpox has subsided with only 1 case being reported for the week ended September 15, 1951, as compared with 32 for the previous week.

Indochina. For the week ended September 8, 1951, 15 cases (3 deaths) of smallpox were reported in Cambodia.

Indonesia. Five cases of smallpox were reported in Bandoeng, Java, for the week ended September 1, 1951. For the previous week, two cases were reported. During the week ended September 1, four cases were reported in Balik Papan, Borneo.

Typhus Fever

Indochina. Typhus fever was reported in Viet Nam for the week ended September 15, 1951, as follows: Haiphong two cases and Saigon two.

Iran. During the week ended September 15, 1951, three cases of typhus fever were reported in Tabriz.

Yellow Fever

Colombia. During the period August 15–24, 1951, four fatal cases of jungle yellow fever were reported in the county of San Vicente de Chucuri, Santander Department.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price per year—$4.75, domestic; $6.25, foreign.

Public Health Reports

VOLUME 66 **OCTOBER 19, 1951** NUMBER 42

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Public Health Reports

Vol. 66 • OCTOBER 19, 1951 • *No. 42*

Experience with a Streamlined Examination

—Hot Springs National Park Cancer Investigation Center—

By ALLEN N. KOPLIN, M.D.*

Since cancer often presents no symptoms in its early stages, it has been suggested that symptom-free individuals submit to periodic examination in the hope that incipient disease can thus be discovered. More than 200 cancer detection centers or clinics have been established for this purpose, and a widespread educational campaign has been conducted for a number of years to make every doctor's office a cancer detection center.

At present, periodic examinations for the early detection of disease, which are relatively comprehensive and include a history, physical examinations, and laboratory tests, are not available to an appreciable proportion of the population. Overworked doctors are forced to devote their time to the patient with symptoms and find it difficult to encourage symptomless persons to undergo periodic examinations. Low income wage earners and the indigent, who cannot afford to purchase medical care during obvious illness, are not likely to seek examinations when symptom free. Since comprehensive periodic health examinations are not yet generally available, other more expedient techniques have been developed.

Multiphasic screening of whole community and industrial plant populations is one possible answer to the problem of early detection. A "streamlined" health examination is another. Evaluation of one trial of the examination technique for detecting cancer can be made through the experience gained by a pilot cancer investigation unit affiliated with the Public Health Service Medical Center at Hot Springs, Ark.

The effectiveness of the Hot Springs technique, described here, is measured in terms of cancer discovered and the costs of discovery. The coincidental discovery of other significant defects by means

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of this procedure is also evaluated. Since the aim of detection is prompt treatment and care, the follow-up system used is described.

The study was conducted on venereal disease suspects at the Hot Springs Public Health Service Medical Center, where such persons are examined and given rapid treatment if necessary.[1] Persons in the older age groups were examined at the cancer investigation center established within the medical center for this purpose.

The Examination Procedure

The History

A brief screening history was taken by specially trained nonmedical assistants. All positive or suggestive replies to questions designed to elicit cancer symptoms were called to the attention of the examining physicians by means of a special history check-sheet.[2] This procedure was completed in about 15 to 20 minutes.

The Physical Examination

Specially trained examining physicians performed a limited physical examination. This included, among other things, breast, pelvic, and rectal examination in females, and rectal examination in males.[3] Wherever suspicious lesions were observed, biopsy was performed. Laboratory procedures, such as complete blood counts, hemoglobin determinations, serologic tests for syphilis, and urinalyses were also performed. Patients with rectal bleeding, a history of hemorrhoids, or melena, or other signs and symptoms of lower bowel disease, were instructed to return in 24 hours, after preparation, for proctoscopy and sigmoidoscopy. The cytologic test for uterine cancer was provided all females and will be evaluated more extensively in a separate report.

Referral for Further Diagnosis and Treatment

All patients requiring further diagnostic work-up and treatment were informed of abnormal findings and given specific advice as to when and where further examinations and treatment could be obtained. Cancer suspects were followed up to insure prompt treatment. Patients with incomplete presumptive findings were summoned back to the center.

Role of the Public Health Nurse in Pretreatment Follow-up

The public health nurse was an important member of the investiga-

[1] The use of a largely syphilitic population was considered satisfactory for the evaluation of an examination technique, especially in view of the availability of a well-equipped service facility. No epidemiologic research was intended, and the only epidemiologic observations made deal with the relationship between syphilis, cervical lesions of all types, and cervical cancer.

[2] See "Patient's History" form, Hot Springs Cancer Investigation Center.

[3] See "Physical Examination" form, Hot Springs Cancer Investigation Center.

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HOT SPRINGS CANCER INVESTIGATION CENTER

Patient's History

Cancer Control

Clinic No ....

C. C. U. No. ....

Name (Last) (First) (Middle)			Date	
Age	Date of birth (Month, year)	Sex ☐ Male ☐ Female	Color	Marital status S M W D	Weight

I. Family history of cancer (Died of cancer? Age at death, type)

II. Past history

(1) Medical

(2) Surgical

(3) Venereal disease

Menstrual history	Cycle	L. M. P.
	Metrorrhagia	Menorrhagia
	Menopause (date)	Hormonal treatment
	Post menopausal bleeding	X-ray treatment
Obstetrical	Number of pregnancies	Number of children
	Were babies breast fed?	Average length of time

III. Habits (Smoking)

IV. Systemic review

(1) General	Weight loss	Weakness	
(2) Head and neck	Chronic hoarseness	Dysphagia	Mouth sores
(3) Lungs	Chronic cough	Hemoptysis	Chest pains
(4) Stomach	Appetite	Abdominal pain	Indigestion
(5) Rectum	Change in bowel habits	Blood in stool	Melena
(6) Skin	Lumps	Sores	Skin operations
(7) Genito-urinary	Hematuria	Frequency	Dysuria
(8) Breasts	Lumps	Nipple discharge	Tenderness
(9) Gynecologic	Vaginal discharge	Bleeding	Pelvic pain

HOT SPRINGS CANCER INVESTIGATION CENTER

PHS-777-2 (NCI)
4-48
Physical Examination
Cancer Control

Clinic No. ....

C. C. U. No. ....

Name (Last)	(First)	(Middle)	Date

Age	Date of birth (Month, year)	Sex	Color	Marital status	Weight
		☐ Male ☐ Female		S M W D	

Local evidence tumor disease:

General physical condition:

Skin:
Inspection:
Palpation:

Intraoral:
Inspection:
Palpation:

Neck:
Masses:
Tenderness:
Thyroid:

Breasts:
Masses:
Tenderness:
Nipple discharge:

Lungs:
Auscultation:
Percussion:

Heart:
BP ______________________ P ______________________
Rhythm: Apex:
Murmurs:

Abdomen:
Masses:
Tenderness:
Rigidity:
Palpable viscera:
Scars:

Pelvic:
Ext. Genitalia: Urethra:
Vagina:
Cervix:
Uterus:
Adnexae:

Male genitalia:

Rectal:
Anus: Hemorrhoids:
Masses:
Tenderness:
Prostate:

Back and extremities:

Lymphatic system:

Tumor diagnosis:
Provisional:
Cytological:
Final:

Other diagnoses:
(1)
(2)
(3)

Disposition:

Physical done by Dr. ....

Follow-up notes:

tion center staff. In general, she was responsible for bridging the gap between the presumptive diagnosis of cancer and definitive treatment. "Pretreatment follow-up" by the nurse included vigorous efforts to obtain hospitalization and treatment of patients, and the maintenance of detailed follow-up records for all cancer patients and others requested to return for rechecks. The Arkansas State Cancer Commission, the University of Arkansas Hospital, various community hospitals and clinics, and private physicians cooperated in providing diagnostic service and treatment.

Although the public health nurse assumed a specialized function in a pilot study of this type, this does not imply that a similar specialized nurse would be necessary in the average detection center. Aside from broad administrative planning and staff education, which are usually the function of top-level cancer nursing consultants, most of the follow-up duties could logically be assigned to a staff level nurse. While carrying a generalized program, staff nurses could, for example, serve community detection centers in much the same manner as they serve well-baby clinics and adult health clinics. In all three, duties would be very similar; for example, discovering suspects in the home; scheduling appointments; interviewing patients; following-up on doctors' recommendations; drawing upon community resources in order to obtain medical care for patients; and providing or demonstrating nursing care in the home.

Analysis of Case Material

Description of the Study Group

The study group consisted of 1,987 women who were examined between November 13, 1947, and July 14, 1948.[4] The group was composed largely of impoverished share croppers living in a Southern rural environment and usually dependent upon the cotton crop as their sole source of income. Of those examined, 92.6 percent were Negro and 7.4 percent were white.

Eighty percent were between 35 and 49 years of age. Less than 2 out of every 10 examinees were 50 years of age and over. The virtual absence of examinees under 30 years of age is the result of selection, for only the oldest individuals admitted to the center each day were chosen for examination (table 1).

Cancer Cases Compared With Other Defects

Excluding venereal disease, 1,836 (92.4 percent) of the 1,987 examinees were found to have defects, and 151 (7.6 percent) were found free of defects. Cancer was found in 41 (2.1 percent) of the

[4] Male patients were being examined routinely at the completion of the study period, but the number was too small for inclusion in this analysis.

Table 1. *Distribution of females in study group by age and color, Hot Springs cancer investigation center, Nov. 13, 1947, to July 14, 1948*

Age in years	All classes		White		Negro	
	Number	Percent of all ages	Number	Percent of all ages	Number	Percent of all ages
All ages	1, 987	100. 0	147	100 0	1, 840	100. 0
Under 30	15	.8	2	1. 4	13	.7
30–34	33	1. 7	9	6 1	24	1 3
35–39	650	32. 7	44	29. 9	606	32 9
40–44	500	25 5	38	25 9	470	25. 5
45–49	433	21. 8	25	17 0	408	22 2
50–54	164	8 2	15	10. 2	149	8 1
55–59	93	4 7	5	3 4	88	4. 8
60–64	47	2 4	3	2. 0	44	2. 4
65–69	33	1. 7	5	3. 4	28	1. 5
70–74	6	.3	1	.7	5	.3
75 and over	5	.2	0	0	5	.3

examinees. (See table 2.) The proportion of cancer cases found is slightly higher than that of other similar cancer detection centers (*2*), and the proportion of individuals with other nonvenereal defects (90.3 percent) is very much higher than the average reported for other centers. The composition of the study group is, of course, not comparable with the urban clientele of most cancer detection centers and may explain in part the higher incidence of cancer and other defects.

The incidence of cancer compared with other defects, excluding venereal diseases, follows:

	Number	*Percent*
Total examinees	1, 987	100. 0
With defects	1, 836	92. 4
Cancer	41	2. 1
Other	1, 795	90. 3
Without defects	151	7. 6

Cancer Case—Age and Site

The fact that one-third of all cancer patients were in the age group 35–39 may be in keeping with the growing belief that cancer, particularly cervical cancer, occurs rather frequently in young Negro women of child-bearing age. Cervical cancer made up four-fifths of all cancer cases (table 2). The high incidence of cervical cancer, both in the Hot Springs study and in the experience of other detection centers, may possibly be attributed to two factors: (1) Cervical cancer is known to occur more frequently than cancer of many other sites among female examinees in the child-bearing ages; (2) the cervix is easily accessible to the examiner so that biopsy may be performed with little difficulty, and therefore the diagnosis is made more often than in cancer of less accessible sites.

There was a relative dearth of breast cancer cases. The absence of cancer of the uterine fundus, the gastrointestinal tract, and other

Table 2. *Number of Negro female examinees with cancer, by age and site*

Age in years	Site of cancer						
	All sites	Cervix	Breast	Vulva	Mouth	Tonsil	Liver
All ages	[1] 40	32	3	2	1	1	1
Under 30							
30-34							
35-39	13	12					1
40-44	9	9					
45-49	7	6	1				
50-54	6	3	1	2			
55-59	2	2					
60-64							
65-69	1				1		
70-74	1					1	
75 and over	1		1				

[1] In addition, there was 1 white examinee, 35 years of age, with advanced adenocarcinoma of the thyroid.

important sites points to a possible deficiency in the examination technique used. Diagnostic dilatation and currettage and routine gastrointestinal X-ray studies were not performed since these extensive procedures were not considered suitable for a large-scale screening program. The problem of devising streamlined techniques to detect the so-called "internal" or "inaccessible" cancers in a large group of presumably well individuals has yet to be solved.

Results of Follow-Up of Cancer Cases

Of the 41 cancer cases, 6 had advanced to the stage where only palliative treatment was indicated. The 35 remaining cases were candidates for prompt attention, and 29 were placed under treatment. Twenty cases were admitted for treatment within 5 weeks after diagnosis. The longest delay between discovery and admission to a treatment facility was 203 days and the shortest, 4 days; the average delay was approximately 49 days.

Nonvenereal Defects Other Than Cancer

Perhaps the most striking aspect of the entire study was the number of defects of all types discovered. In the total group of 1,987 women, 4,512 defects were discovered, an average of 2.3 per examinee. The various kinds of defects in the order of frequency are summarized in table 3. Because the examination procedure was not comprehensive enough to yield a definitive diagnosis in every case, the broad concept of defects was used.

The most prevalent defect in the study group was hypertension which, for the purposes of this study, was defined as a blood pressure consistently higher than 140/90. Hypertension among the Negroes accounted for over 25 percent of all defects, while among the whites it accounted for only 15.3 percent. This seems to corroborate the observations of others (*3*, *4*) regarding the high incidence of hypertension among Negroes.

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Cancer stood in twelfth place from the standpoint of frequency in the group.

Table 3. *Nonvenereal defects in study group, by specific defect and by race* [1]

Defects	Number			Percent		
	All classes	White	Negro	All classes	White	Negro
Total	4,512	307	4,205	100.0	[2] 100.0	100.0
Hypertension	1,124	47	1,077	24.9	15.3	25.6
Cervical lesions	1,060	96	964	23.5	31.3	22.9
Cervicitis	643	52	591	14.2	16.9	14.0
Cervical erosion	157	21	136	3.5	6.9	3.2
Cervical cyst	144	11	133	3.2	3.6	3.2
Cervical polyp	77	8	69	1.7	2.6	1.6
Cervical laceration	32	4	28	.7	1.3	.7
Cervical leukoplakia	7	0	7	.2	0	.2
Benign tumors	539	32	507	[2] 11.9	[2] 10.4	12.1
Fibroid tumors	390	16	374	8.6	5.2	8.9
Fibroma of skin	47	5	42	1.0	1.6	1.0
Lipoma	25	3	22	.6	1.0	.5
Multiple nevi	19	3	16	.4	1.0	.4
Thyroid adenoma	15	0	15	.3	0	.4
Ovarian tumor	15	1	14	.3	.3	.3
Fibroadenoma of breast	12	0	12	.3	0	.3
Hyperkeratotic warts	9	2	7	.2	.6	.2
Hemangioma of nose	5	2	3	.1	.6	.1
Neurofibromatosis	2	0	2	.0	0	.0
Chronic and disabling pelvic disorders [3]	388	39	349	8.6	12.7	8.3
Senile vaginitis	150	13	137	3.3	4.2	3.3
Pelvic adhesions	75	7	68	1.7	2.3	1.6
Cystocele	41	5	36	.9	1.6	.9
Rectocele	27	4	23	.6	1.3	.5
Retroverted uterus	20	2	18	.4	.7	.4
Barthelin cyst	14	2	12	.3	.7	.3
Tubo-ovarian mass	12	2	10	.3	.7	.2
Procidentia	9	1	8	.2	.3	.2
Anal or rectal stricture	9	0	9	.2	0	.2
Rectovaginal fistula	8	1	7	.2	.3	.2
Perineal lacerations	7	0	7	.2	0	.2
Vaginal stricture	6	1	5	.1	.3	.1
Chronic salpingitis	4	0	4	.1	0	.1
Monilia vaginitis	4	1	3	.1	.3	.1
Oophoritis	2	0	2	.0	0	.0
Cardiac pathology	262	15	247	5.8	[2] 4.9	5.9
Aortic insufficiency	175	11	164	3.9	3.6	3.9
Mitral murmur	26	2	24	.6	.6	.6
Hypertensive heart disease	26	2	24	.6	.6	.6
Extrasystoles	18	0	18	.4	0	.4
Pulmonic murmur	11	0	11	.2	0	.3
Hypertension with decompensation	3	0	3	.1	0	.1
Rheumatic heart disease	2	0	2	0	0	.0
Coronary insufficiency	1	0	1	.0	0	.0
Anemia	255	11	244	5.7	3.6	5.8
Hemorrhoids	219	25	194	4.9	8.1	4.6
Dental caries	118	12	106	2.6	3.9	2.5
Buccal leukoplakia	87	1	86	1.9	.3	2.0
Obesity	56	3	53	1.2	1.0	1.3
Thyroid disease	49	3	46	1.1	1.0	1.1
Goiter, nontoxic	45	3	42	1.0	1.0	1.0
Goiter, toxic	4	0	4	.1	0	.1
Cancer	41	1	40	.9	.3	1.0
Glycosuria	27	1	26	.6	.3	.6
Hernia	21	1	20	.5	.3	.5
Hypertrophic tonsils	18	1	17	.4	.3	.4
Urethral caruncle	14	1	13	.3	.3	.3
All other defects	234	18	216	5.2	5.9	5.1

[1] Includes multiple defects found in many examinees.
[2] Due to rounding of numbers the percentages do not add up to indicated total.
[3] Benign tumors are excluded.

A multiplicity of nonvenereal defects was revealed by the examinations: 27.5 percent of the examinees had at least two defects, and 21.6 percent had at least three defects. Only 151 individuals, or 7.6

percent, had no demonstrable defects. The distribution of female examinees by number of nonvenereal defects is given below:

Number of defects per examinee	*Number of examinees*	*Percent of total examinees*
Total	1, 987	100. 0
None	151	7. 6
1	502	25. 3
2	546	27. 5
3	430	21. 6
4	229	11. 5
5	85	4. 3
6	25	1. 2
7	15	. 8
8	4	. 2

The high prevalence of defects observed among the Hot Springs examinees is not surprising considering the socioeconomic status of the patients. For example, the incidence of cervical lesions (almost 23 percent of all defects) has been related to lack of obstetrical and gynecological care. Although syphilis must be considered a potential factor in the development of cervical lesions, it is shown below that the incidence of cervical lesions among syphilitic examinees was not significantly higher than in the nonsyphilitic group.

Syphilis and Cancer

For many years it has been generally believed that cancer of certain sites, that is, tongue and uterine cervix, is more prevalent among individuals with syphilis than among the general population (*5*, *6*). In the present study, however, which deals with a predominantly syphilitic-female population, this relationship has not been observed. For example, out of 1,987 women examined, 1,753, or 88.2 percent, had proven syphilis, while 210, or 10.6 percent, were nonsyphilitic. Yet, as seen in table 4, the proportion of all types of cervical lesions and of cancer itself among both groups was very similar.

Table 4 represents an attempt to correlate the presence of syphilis, cervical lesions, and cancer in the study group. Although 40.3

Table 4. *Comparison of the number and percent of examinees having cervical lesions and cervical cancer in the syphilitic group, in the nonsyphilitic group, Hot Springs Cancer Detection Center, Nov. 13, 1947, to July 14, 1948*

Item	Number of examinees				Percent of total examinees			
	Total	With syphilis	Without syphilis	Unknown syphilis	Total	With syphilis	Without syphilis	Unknown syphilis
Total	1,987	1,753	210	24	100.0	100.0	100.0	100.0
Without cervical lesions	1,190	1,046	128	16	59.9	59.7	61.0	66.7
With cervical lesions of all types	797	707	82	8	40.1	40.3	39.0	33.3
With cancer of cervix	32	27	4	1	1.6	1.5	1.9	4.1

percent of the syphilitic group had cervical lesions, almost an equal proportion of the nonsyphilitic group, 39.0 percent, also had cervical lesions.

Cervical cancer occurred in only 1.5 percent of the syphilitic group in comparison with 1.9 percent of the nonsyphilitic group. Since the age distribution of both groups is similar, and since there is no significant difference between the proportion of cancer cases in each group, any etiologic relationship between syphilis and cancer may be nonexistent or masked by other unknown factors. It has also been suggested that the syphilitic infections were of insufficient duration to warrant the conclusion that their influence on the development of cancer will not become apparent later.

Histologic and Cytologic Examinations

There were 503 examinees who had at least one biopsy during the study, and of this number 456 individuals had at least one biopsy of the cervix uteri. The frequent use of the cervical biopsy is not surprising in view of the prevalence of cervical lesions among the study group. During the study period, 797 of the 1,987 examinees, or 40.1 percent, were found to have at least one type of cervical lesion.

Costs

The costs of operating the "pilot" cancer detection center are presented in table 5. All initial expenditures for nonexpendable items, such as microscopes, centrifuges, and water baths, which would be found in any hospital laboratory are excluded. The figures presented are therefore estimates of operating costs only.

Very little material in the literature deals with the subject of cancer detection center costs. Many general statements have appeared estimating the cost of discovering a case of cancer from as

Table 5. *Analysis of costs of operation, Hot Springs cancer investigation center, Nov. 13, 1947, to July 14, 1948*

Total operating expenses [1] — $37, 505. 84		
Number of visits	2, 104	
Total cost per visit	------	$17. 82
Number of operating days	169	
Total cost per operating day	------	221. 93
Number of cancer cases found	41	
Total cost per cancer case	------	914. 78
Number of examinees with defects	1, 836	
Total cost per examinee with defects	------	20. 43
Number of defects found	4, 512	
Total cost per defect found	------	8. 31

[1] Total operating expenses include: salaries, $25,488.59; supplies (expendable), $3,471.09; transportation, $1,273.87; overhead, $4,002.29, plus $3,270 for biopsy expense. Total, $37,505.84 (cytologic test, $12,756.32, and clinic, $24,749.52).

low as $1,000 (*7*), or less, up to $25,000 (*8*). Others have placed costs at about $7,000 to $8,000 (*9*) per case of cancer discovered—somewhere between the two extremes. In one of the few actual analyses of detection centers in which costs were determined for 10 detection centers in New York City (*10*), costs ran about $6,486 per cancer case discovered. In the Hot Springs project, using the described examination technique, the cost came to approximately $914.78 per case.

Table 5 shows that for the study period operating expenses amounted to $37,505.84. The cost per visit was $17.82. The cost per defect found was but $8.31. When the costs of the cytologic test are deducted, the net costs are reduced to $11.76 per visit, and $5.48 per defect found.

Discussion

Until the laboratory investigator provides the clinician with better diagnostic tools, detection centers probably cannot be considered practical for the discovery of inaccessible asymptomatic cancer. This would seem to justify further contraction or streamlining of the procedure to eliminate all procedures, such as auscultation of the heart, and blood pressure determination, except those capable of detecting accessible cancer.

On the other hand, the yield of other defects suggests that with minor expansion the Hot Springs routine might be adapted to serve as a streamlined general examination, either in the physician's office or in adult health clinics, for the detection of all statistically significant diseases of adults. (The cost per case of hypertension was only $33.37.)

This study has demonstrated the potentialities of a field follow-up mechanism established as an integral part of a detection center's operation. Since cancer control is not achieved with cancer detection alone, it should be possible for those with responsibility for first suspecting its presence to make arrangements to expedite treatment, thereby preventing fatal delays.

Summary

The examination procedure used in a "pilot" cancer investigation unit affiliated with the Public Health Service Medical Center, Hot Springs, Ark., is described and evaluated from the standpoint of disease discovered and costs.

Defects were reported in 92.4 percent of the 1,987 examinees. Cancer was found in 2.1 percent of all examinees. About one-third of all cancer patients were in the 35–39 year age group. Cervical cancer accounted for four-fifths of the cases and only one cancer of an internal site was discovered. Of the 35 patients with cancer who

were candidates for prompt treatment, 29, or about four-fifths, were placed under treatment as a result of the follow-up mechanism described.

Nonvenereal defects other than cancer were reported in 90.3 percent of examinees, and the majority had two or more defects.

Examinees having biopsies totaled 503, and 456, or 90.7 percent, of these had cervical biopsies. More than 40 percent of all examinees had at least one type of cervical lesion. A definite relationship between syphilis and cervical cancer was not observed.

ACKNOWLEDGMENTS

Acknowledgment is made of the assistance given by Samuel A. Marcus, Biostatistician, and R. Louise Bryson, Records Analyst, National Cancer Institute, in the records analysis and statistical evaluation of the data, and by Grace A. Donovan, Senior Assistant Nurse Officer, National Cancer Institute, in supplying information on the follow-up phases of the study.

REFERENCES

(*1*) Koplin, Allen N.: Objectives and program of the Arkansas cancer detection project. Pub. Health Rep. **63**: 813–826 (1948).
(*2*) L'Esperance, Elise: The early diagnosis of cancer. Bull. New York Acad. Med. **23**: 394–409 (1947).
(*3*) Hartnett, W. G., and Ratcliffe, H. E.: Study in hypertension on southern Negro. South. M. J. **41**: 847–848 (1948).
(*4*) Weiss, Morris M., and Prusmack, John J.: Essential hypertension in the Negro. Am. J. Med. Sc. **195**: 510–516 (1938).
(*5*) Levin, Morton L.: The epidemiology of cancer. Am. J. Pub. Health **34**: 611–620 (1944).
(*6*) Levin, Morton L., Kress, Louis C., and Goldstein, Hyman: Syphilis and cancer. New York State J. Med. **42**: 1737–1745 (1942).
(*7*) Rhoads, C. P.: Preventive medicine in the cancer field. New York Med. **111**: 7–19 (1947).
(*8*) Cancer diagnostic facilities and detection centers. Editorial. J. A. M. A. **138**: 132 (1948).
(*9*) Waters, Charles A., and Kaplan, Ira I.: Introduction on radio-therapeutics *in* Year Book of Radiology, 1947, pp. 209–210.
(*10*) Unpublished survey of cancer detection centers. American Cancer Society, New York, 1947.

Some Conditions Leading to Medical Dependency in Hagerstown, Md.

By P. S. Lawrence, Sc.D.*

The Maryland medical care program was started in 1945 in Washington County, Md. This program provides for payment by the State of medical expenses for all public assistance recipients and for others who, although not on assistance rolls, are unable to pay for their medical requirements (*1*). Although persons receiving public assistance are automatically certified for medical care under the program, many assistance recipients have requested no medical services. Persons who are not assistance recipients may be certified for medical care for a specific illness or for a limited time. From November 1945 through May 1950, a total of 5,503 white residents of the county were receiving public assistance or were individually certified and thus were eligible for this medical service.

Some of these 5,503 persons had been included in a survey of health and socioeconomic status conducted by the Public Health Service 25 years earlier. It is therefore possible to examine certain general features in the history of the surveyed persons who later received medical care under the State program. These persons were found to differ in 1923 from the remainder of the survivors of the original survey in the following general characteristics:

1. They were, even in 1923, within the lowest income group of the population. Only 1.7 percent of the medical care recipients in 1945–50 were in well-to-do or comfortable circumstances in 1923, while 78.0 percent were poor or very poor in 1923. Among those who were not certified for medical care under the Maryland program in 1945–50, 10.5 percent were in well-to-do or comfortable economic circumstances in 1923, while 43.9 percent were poor or very poor at that time. Of all families that were very poor in 1923, 15.4 percent had one or more members who were recipients of State medical care in 1945–50.

2. During the period 1923–43, as could have been expected, a larger proportion of recent medical care recipients than of others had suffered a gross decline in socioeconomic status, the percentages being 15.3 and 4.4, respectively. About 1 percent of the persons in families that had improved in economic status and 10.5 percent of

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those in families with a decline in status became medical care recipients under the State program in 1945–50.

3. The medical care recipients were, as a group, older persons than persons who were not medical care recipients, and the proportion of such recipients increased with age. This finding presumably reflects the financial burdens imposed by chronic illness and the high proportion of recipients of old-age assistance (aged 65 and over) who are chronically ill.

4. The prevalence of chronic illness in 1923 was significantly higher among persons who became medical care recipients in 1945–50 than among other persons included in the survey. The prevalence rates, adjusted for differences in age and economic status, were 35.3 and 19.2 per 100 for the two groups, respectively. No difference was found between the two groups with respect to the extent of acute illnesses in 1921–23.

Material

From 1921 through 1923, a family survey was conducted in Hagerstown, Md. (*2*). This survey included all classes of the population. Each family was rated as well-to-do, comfortable, moderate, poor or very poor, with ratings based on occupation and the interviewers' observation of the apparent general standard of living, rather than on actual family income. At 6-week intervals a trained field worker visited each family and recorded information on the acute illnesses and attacks of chronic diseases that had occurred since the previous visit. Table 1 shows that in the 1923 survey there were 5,622 persons who had been observed for 12 months or longer and who were members of 1,310 unbroken families (husband and wife both alive and in the same household). By 1945 the number of families in which at least one parent was still alive and living in the Hagerstown area had decreased to 1,002 and, through death or departure from the household of parents or children, the number of remaining persons was 2,181.

Among the 2,181 persons remaining in 1945 were 59 persons who received medical care under the State program in 1945–50 and 28 others who were not themselves certified for medical assistance but

Table 1. *Distribution of persons and families in the original 1923 survey according to status of family members under State medical care program, 1945–50*

Status	1923 survey population		Status under State medical care program, 1945–50			
			Nonrecipient		Recipient	
	Persons	Families	Persons	Families	Persons	Families
Included in 1923 survey	5,622	1,310	5,392	1,260	230	50
Died in 1923–45	1,148	308	1,113	308	35	
Left household during 1923–45	2,293		2,185		108	
Remaining in 1945	2,181	1,002	2,094	952	87	50

who were in the families and households of the 59, making a total of 87 in these families.

In all, 2,094 persons canvassed in 1923 and residing in the households reviewed in 1945 were not related to the 59 medical care recipients. These 2,094 persons are compared with the 59 recipients of medical care under the State program as to their socioeconomic history and prevalence of chronic and acute illnesses during the 1923 survey. Similar comparisons are made between 952 families of persons who did not receive State medical care and 50 families of medical care recipients. Throughout this report the use of recipient and nonrecipient refers to status under the State medical care program in 1945–50. No one in this study was receiving organized medical or welfare aid during the 1921–23 survey.

Socioeconomic History

Table 2 shows the percentage of persons in each socioeconomic class in 1923 among persons who procured their own medical care and among persons whose care was provided by the State in 1945–50. The difference in the 1923 socioeconomic distributions of the two groups is evident. In the last column of this table, the percentage of medical care recipients varies inversely with economic status in 1923. These proportions are adjusted by the indirect method [1] for age differences between the recipients and the nonrecipients.

When similar comparisons are made for families, rather than for individuals, one finds that among the families that were in well-to-do circumstances in 1923 none had members who were medical care recipients in 1945–50, and among the families in comfortable circumstances 1.0 percent became medical care recipients. Among the families in moderate circumstances 2.2 percent, among the poor, 8.3

Table 2. *Socioeconomic status in 1923 of persons who were nonrecipients or recipients of State medical care, 1945–50*

Socioeconomic status in 1923	Total		Status under State medical care program					
			Nonrecipient		Recipient		Percent in recipient group	
	Number	Percent	Number	Percent	Number	Percent	Observed	Adjusted [1]
All	2,153	100.0	2,094	100.0	59	100.0	2.7	2.7
Well-to-do	61	2.8	61	2.9	0	0	0	0
Comfortable	165	7.7	164	7.8	1	1.7	.6	.2
Moderate	981	45.6	969	46.3	12	20.3	1.2	1.2
Poor	853	39.6	813	38.8	40	67.8	4.7	4.6
Very poor	93	4.3	87	4.2	6	10.2	6.5	7.9

[1] Adjusted for differences in age between the recipient and nonrecipient groups.

[1] This is the method described by Pearl (5) as "adjusted rates (a)." The total population of the sample is used as the standard.

965690—51——3

percent, and among the very poor 15.4 percent had members receiving medical care from the State in later years. These proportions are adjusted for age differences between the two groups.

All persons in this report were included in a second survey (*3*) conducted in 1943. The field worker had the original 1923 data at hand and rated each family as having an improved, unchanged, or reduced socioeconomic status during the 20-year interval. Ratings were made on the basis of comparisons between the 1923 and the 1943 location and condition of their dwellings, their occupations, and the extent and types of their employment. The improvement and decline in economic status represented grossly observable changes, whereas the "unchanged" group necessarily represented a range of slighter changes in socioeconomic condition. During the war, wages and employment in Washington County were at a high level. Principally for this reason only 4.4 percent of the nonrecipient survivors of the original survey group declined in economic status, while 17.1 percent showed an improvement. In contrast, among the medical care recipients 15.3 percent had declined in status and 5.1 percent had experienced an improvement. When each category of change in status is examined according to the percentage of persons who became medical care recipients, one finds that 1.3 percent of all persons in families which had improved their status between 1923 and 1943 had become recipients by 1950, whereas 2.6 percent of all persons whose family economic status remained unchanged and 10.5 percent of all persons in families with a reduced status became medical care recipients. Again these percentages are age adjusted.

Age

How does the age distribution of the medical care recipients compare with that of other persons in the survey group? Table 3 shows that the recipient group is weighted with older persons. This difference in the age composition of the recipient and nonrecipient populations is reflected in the variation shown in the proportion of persons in each age group who later became medical care recipients.

The relationship between age and receipt of medical care under the State program is seen also for families. Only 1.6 percent of the families in which the father was under 30 years of age in 1923 had a member receiving medical care from the State in 1945–50. For fathers 30–39 years of age the proportion of the families that had members who were later receiving medical aid at State expense was 3.4 percent; for fathers 40–49 years of age it was 6.4 percent; and for fathers aged 50 and over it was 8.7 percent.

Certification for care under this program depends upon economic standards and, for persons certified for medical care only, also upon

Table 3. *Age in 1923 of persons who were nonrecipients or recipients of State medical care in 1945–50*

Age in 1923	Total		Status under State medical care program				
			Nonrecipient		Recipient		Percent in recipient group
	Number	Percent	Number	Percent	Number	Percent	
All	2,153	100.1	2,094	99.9	59	100 0	2.7
Under 20	592	27 5	583	27.8	9	15.3	1.5
20–39	1,022	47 5	1,004	47 9	18	30.5	1.8
40–49	376	17.5	354	16.9	22	37 3	5.9
50 and over	163	7.6	153	7.3	10	16 9	6.1

the nature of the disease. Persons with prolonged illnesses which are likely to place a severe strain on already low resources are most readily certified. Since the prolonged illnesses are largely chronic diseases among older persons, the method of selection results in an age differential between the recipient and the nonrecipient groups.

The factor of the older persons having suffered a greater decline in economic resources also has a bearing on the larger proportion of medical care recipients among persons in the older age groups. During the period from 1923 to 1943, 6.7 percent of the persons over age 40 in 1923 suffered a decline in economic status as compared with 3.5 percent among persons under age 20 in that year. In the older group, 8.5 percent improved in status, as contrasted with 23.5 percent in the younger group.

Chronic Illness

To assure complete recording of chronic illness in the 1921–23 survey, this report includes only persons who were observed for 12 months or longer. The causes of chronic illness are listed in an earlier report of these data (*4*). Table 4 presents the percentage of persons who were chronically ill in 1923 among the medical care recipients in 1945–50 and among the nonrecipient group. Because of differences between the two groups in age and economic classification, these figures have been adjusted by the indirect method to make them comparable. The probability is less than 1 in 100 that a difference as great as or greater than the difference between the rates shown could have arisen by chance. It is apparent that those who are now medical care recipients had a greater amount of chronic illness 20-odd years ago than persons who are not now recipients.

In 1923 one or more persons was chronically ill in 51.6 percent of the 952 families that were not medical care recipients in 1945–50, whereas there was chronic illness in 72.0 percent of the 50 families who were medical care recipients in 1945–50. These crude rates, however, exaggerate the difference in the prevalence of chronic illness in the two groups of families. When adjusted by the indirect method

Table 4. *Prevalence of chronic illness in 1923 among recipients and nonrecipients of State medical care in 1945–50*

Status under State medical care program, 1945–50	Chronic illness status, 1923				
	Total	Well, 1923	Chronically ill, 1923	Observed percentage ill	Adjusted percentage ill [1]
All	2,153	1,731	422	19 6	19.6
Nonrecipient	2,094	1,697	397	19.0	19.2
Recipient	59	34	25	42.4	35.3

[1] Adjusted for differences in age and socioeconomic status between the recipient and nonrecipient groups.

for age of father and economic status, the rates are 51.9 and 64.4 per 100 for the nonrecipient and recipient groups, respectively. The probability of chance occurrence of a difference as great as or greater than this is .05.

Acute Illness

During the original survey of 1921, detailed records of acute illnesses were maintained. When adjusted for age and economic differences, the attack rates per person year of observation were 0.92 for persons who are now medical care recipients and 0.86 for those who are not recipients. The two groups therefore show no appreciable difference with respect to the amount of acute illness in 1921–23.

Persons No Longer in Household

The foregoing comparisons are, of necessity, limited to persons who were surviving and in the households in 1945–50. It is of interest to compare the recipient and the nonrecipient groups with respect to family members who died or who left the households before the State medical care program started. Of the 5,392 persons originally in the families of nonrecipients, 61.2 percent were "lost" to the household by 1945. Among the 230 original members of the families containing medical care recipients, 62.2 percent were "lost" to the household. Although these percentages are approximately the same, the mortality rates and the rates of leaving the households vary for the two groups. The mortality rates over the 22-year span were 20.6 per 100 persons in the nonrecipient families, and 15.2 per 100 persons in the families which later had members who were medical care recipients. This difference is largely due to a difference in the age structures of the populations. As explained earlier, persons certified for medical care under the State program were, as a group, older than the others included in the survey. For the original members of families of recipients and nonrecipients the reverse is true; only 0.9 percent of the members of recipient families were over 60 years of age in 1923 as compared with 5.3 percent over age 60 in the other families. The

age difference is in turn associated with the differences in socioeconomic status. The families that had medical care recipient members were, in 1923, in much poorer socioeconomic circumstances than the other families, and the poorest families had the lowest proportion of aged people. When the mortality rates over the 22-year period are adjusted for age and socioeconomic status they are, for all practical purposes, the same, being 19.9 and 18.5 for the nonrecipient and recipient groups, respectively.

Between 1923 and 1943, 40.5 percent of the persons in nonrecipient families and 47.0 percent of those in recipient families had left their original households. Again this difference is largely a matter of age and socioeconomic status since the members of recipient families were, on the average, younger than those of the nonrecipient families, and the bulk of the migration was among young persons. Furthermore, the amount of loss from the households was progressively greater with decreasing economic status, ranging from 19 percent of the well-to-do persons to 48 percent of the poor persons. It was noted earlier that the medical care recipients of 1945–50 were among the poorest families in 1923, and thus a greater amount of departure from the home during the intervening years would be expected in this group. When adjusted for age and socioeconomic status, the rates of leaving the household are 40.7 for the nonrecipient group and 41.7 for the recipient group.

Discussion

The present report, combined with the findings of earlier reports on these data, shows that the problems of aging, chronic illness, socioeconomic status, and certification for medical care under the Maryland State medical care program are closely interwoven. Although at any given time there is a greater proportion of economically comfortable persons in the older age groups than in the younger groups, yet the proportion of persons that suffer a decline in economic status over a span of years is higher among the old than among the young. Concurrent with the reduction of earning power which generally accompanies old age is a marked increase in the incidence of chronic illness (*4*). Chronic illness, regardless of which family member is ill, not only tends to curtail income further but also adds considerably to the costs of medical care and maintaining the home, particularly if the family wage earner is the invalid (*6, 7*).

The fact that only one family in well-to-do or comfortable socioeconomic circumstances in 1923 had a medical care recipient in 1945–50 indicates that good economic circumstances acted as a buffer against medical dependency in old age even though chronic illnesses developed in some of these families. At the other extreme, 7.9

percent of the individuals and 15.4 percent of the families that were very poor in 1923 were in the recipient group in 1945. The figures indicate the importance of a high economic level from the standpoint of future medical solvency of the family; prevention of illness and rehabilitation of invalids, moreover, help to prevent a decline in economic status.

It is impossible to determine how much larger the number of medical care recipients might have been were it not for the era of relative economic prosperity experienced thus far during the period of the operation of the State program. Certainly the cost of maintaining the program would increase under less favorable economic conditions. Over a period of years costs may also be expected to rise with increases in the proportion of older persons in the population. Not only has chronic illness constituted approximately half of the diagnoses in the Maryland medical care program, but also patients with chronic diseases have, by and large, required the most expensive care. The association demonstrated in this report between age and future medical dependency is of more than mere statistical interest in revealing the probability that certain income and age groups will require medical assistance. The relationships shown also indicate that in years to come provision for medical care may cause an increasing drain on family and community resources.

Aside from the differences found between the recipient and the nonrecipient groups, it is of interest to determine the reasons why certain persons who were very poor in 1923 did not become medical care recipients and why some others who were in moderate circumstances in 1923 did become recipients.

Of the 87 surviving members of nonrecipient families that were very poor in 1923, 46 were classified as having an improved economic status by 1943. This classification indicates a considerable betterment of socioeconomic condition. An additional 37 were recorded as having no change in status according to the broad groupings employed, but these 37 were listed as poor in 1943 whereas they had been very poor in 1923, indicating that there had been some slight improvement in their status. Only 4 persons (members of 2 families) were recorded as still very poor in 1943, and 3 of these persons reported no chronic illness in the later survey. In all, only 18 of the 87 persons had a chronic disease in 1943. This record of improvement in status and freedom from chronic illness largely explains why this group did not become medical recipients in 1945–50. Other factors, however, are more difficult to assess. For example, even though many of these people were still rather poor in 1943, some of them may not have requested public assistance or medical aid because of pride or of ignorance of the availability of the services. Others, in times of financial crisis, may have obtained help from persons outside the

household. Still others, having become accustomed to substandard living conditions may still appear to be poor even though they now have fewer financial responsibilities, greater income, and possibly some savings. Thus they may have been rated poor or very poor in the 1943 survey though able to meet their medical expenses.

A large proportion of persons who were in poor or very poor circumstances in 1923 and remained in this status in 1943 would be expected to come under the State medical care program. But what factors, obtainable from these data, led to the receipt of medical care under the State program by some persons who had been in comfortable or moderate socioeconomic circumstances in 1923? Since only 13 medical care recipients were in this group, a detailed classification of their characteristics would have little justification. It is of interest to note, however, that none of these persons had improved his economic status over the 1923 rating. Five of the thirteen were chronically ill during both surveys, and an additional five had a chronic disease in 1943. Other members of the family and household of each of the remaining three persons were chronically ill. In addition, the husband had died of a chronic disease between 1923 and 1943 in four families and the wife, in two families. This intensive record of chronic illness and death from chronic illness may in large measure account for the recipient status of the group.

The data of this report are not extensive enough to permit determination of all the factors associated with future receipt of medical assistance. Studies on a larger scale could reveal many of these factors and the independent role of each in the probability of becoming medically dependent. Only when the familial factors that lead to medical dependency have been more precisely defined and the importance of their causal effects have been evaluated, can an effective and economical program for prevention of medical dependency be formulated. Such studies should include the effects of existing buffers against dependency such as private, industrial, and governmental provisions for medical care and financial security in old age.

ACKNOWLEDGMENTS

The author is indebted to Dr. Antonio Ciocco for advice in the preparation of this paper; to Dr. P. F. Prather for use of the medical care data; and to Dr. Selwyn D. Collins for records and information on the original morbidity survey

REFERENCES

(1) Kline, H. M., Terris, M., Hapney, C., and Kramer, N. A.: The Maryland Medical Care Program. A report by the staff of the Subcommittee on Medical Care, Committee on Administrative Practice, American Public Health Association. American Public Health Association, New York, 1948.
(2) Sydenstricker, E.: A study of illness in a general population group. Hagers-

town morbidity studies, No. 1. The method of study and general results. Pub. Health Rep. **41**: 2069–2088 (1926).
(*3*) Ciocco, A.: Chronic sickness in relation to survivorship twenty years later. Human Biol. **18**: 33–48 (1946).
(*4*) Lawrence, P. S.: An estimate of the incidence of chronic disease. Pub. Health Rep. **63**: 69–82 (1948).
(*5*) Pearl, R.: Introduction to Medical Biometry and Statistics. W. B. Saunders Company, Philadelphia, 1940.
(*6*) Boas, E. P.: The Unseen Plague—Chronic Disease. J. J. Augustin, New York, 1940.
(*7*) Lawrence, P. S.: Chronic illness and socioeconomic status. Pub. Health Rep. **63**:1507–1521 (1948).

A National Program for Training Public Health Personnel

By Ellis S. Tisdale*

Massachusetts has shown outstanding evidence of leadership in dealing with the protection of the health of her citizens. In recent months she has responded to the challenge of a Nation-wide and world-wide shortage of trained public health personnel, and is demonstrating effective methods for carrying out field training for all types of public health personnel, including health officers, public health nurses, health educators, sanitary engineers, and sanitarians. The Public Health Service, through its Communicable Disease Center in Atlanta, has participated in the New England Field Training Center where the field training of persons who have completed their academic work is being carried on. Also under way is a training program which offers refresher courses in sanitation to persons throughout New England who are already on the job and need additional instruction in public health methods. I shall outline briefly some of the ways in which the Public Health Service is working with Massachusetts and with many other States in developing improved techniques for field training of public health personnel throughout the Nation.

In developing a national program of field training, the Public Health Service is taking full advantage of its opportunity to draw upon all the available resources in the Nation. These resources include the Kellogg and Commonwealth Foundations, the many schools of public health, the universities which have developed field training to supplement their academic courses, and several States which for years have conducted excellent field training programs.

Communicable Disease Center Training Services

An effort has been made to bring all field training experience and knowledge into focus at one headquarters point. Special opportunities for doing this exist in Training Services, a branch of the Communicable Disease Center at Atlanta, the central headquarters of the field training program of the Public Health Service. Here, over a period of several years, CDC has developed new and improved methods for helping the States develop field training programs. The keynote at this field station is teamwork, a principle which has been followed by a large group of eminent scientists, doctors, engineers, entomolo-

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gists, nurses, and laboratory specialists who carry on a Nation-wide program of applied research in communicable disease control. Because field training is essential in this broad program, CDC is working with the States to assist them in establishing such programs.

During World War II, in Atlanta, sanitary engineers, sanitarians, entomologists, and other public health workers developed effective practical training techniques in malaria and typhus control which were eminently successful. The same principles which were utilized then are now being rapidly expanded to cover the entire field of public health. Perhaps a glance into some of the fundamental concepts upon which the national program of field training for public health personnel is erected will be of interest.

An experimental field training center is continually in operation with headquarters at the Communicable Disease Center. One hundred miles to the south in Columbus, Ga., new field training methods are continually being developed in a city-county health department. The training officers assigned to the Columbus center and to Atlanta headquarters, as well as to all regional training centers, have been selected with great care. Contagious enthusiasm and a missionary zeal as to the relative importance of field training in public health have been basic elements in the specifications for their selection. These training officers must and do have the ability to impart inspiration and enthusiasm to other training officers and trainees studying and doing practical work at these centers.

Public relations is a fundamental concept. The training officer must keep constantly in mind and must practice good public relations. Public speaking and public relations practice are incorporated in all field work given under the auspices of the CDC Training Services Branch.

Periodic working conferences bring the leaders from all regional centers together at headquarters to hold discussions in small groups. Thus, a clearing house on the most effective training methods is operating at Atlanta continuously.

From this central training source, assistance is continually flowing to States which have made beginnings in field training, such as the centers at Gainesville, Fla.; New Orleans, La.; and Austin, Tex. If a special need arises for training in food sanitation in the Florida training center, for example, a request for a training team is dispatched to Atlanta. On the team's arrival at Gainesville, its members place themselves under the direction of the training officer in charge of the State center. Field practice in food sanitation is then made possible through the use of the city-county health facilities.

On another occasion, perhaps, a group of young Latin American medical officers may be completing their master of public health degrees at Tulane University and need a 7- to 14-day period of field

practice in malaria and insect control, with special emphasis on conditions in Latin America. The New Orleans field training center advises Atlanta of its needs, and a two-man training team is dispatched to New Orleans with essential equipment, insecticides, and audio-visual aids. Here, using the State training center as a base, the training officers from Atlanta spend a week or 10 days working with the young medical officers who then return to Latin America to become leaders in organizing and administering public health practices.

Another need might arise in the field of housing sanitation. Key cities and counties in Texas may wish to orient their sanitary engineers and sanitarians in housing evaluation techniques and slum clearance programs. Public Health Service officers in the Federal Security Agency Regional Office at Dallas, working with the State training program at Austin, arrange the time and length of the course to be held at the training center, and request a training team from Atlanta. Members of the team proceed to the State training center and, utilizing local facilities, give the essential orientation and specialized training in housing sanitation that will enable these sanitation leaders in cities and counties in Texas to start housing sanitation programs in their own communities.

For the past year, two-man training teams have been sent on request to Massachusetts, Washington, D. C., Colorado, Missouri, South Carolina, California, and to the Pacific Northwest. The regional training centers, in cooperation with the Regional Offices of the Federal Security Agency, do the essential planning, provide the space, and recruit the personnel. Such decentralized courses of a specialized nature are economical, and fill a real need in many States.

One unique element in the training facilities available from Atlanta is the audio-visual production services. It is a "Hollywood in miniature" without the glamour, but it provides outstanding educational leadership in the preparation of training aids. In this branch are script writers, motion picture and still picture cameramen, editors, sound engineers, and audio-visual production specialists. They produce filmstrips, slides, and motion pictures which can be used at the field training centers. Thus, principles of water supply, waste disposal, rodent and insect control, and milk and food sanitation can be visualized for the trainee. Training officers with teaching experience, who served in the Army and Navy during World War II directing the use of training aids and instructing both officers and enlisted men, are heading this program of putting into practice the rapid-education methods perfected by the armed forces. Now, the effort is being directed toward conserving human life. It is perhaps the first systematic effort in the United States to develop and use training aids which are specially planned and designed for teaching public health principles.

The first course in training methods was scheduled this year at Atlanta. This course is designed for training "trainers"—leaders from regional and from State training centers. Educators from the Georgia Institute of Technology and Emory University and specialists in the use of audio-visual training aids cooperated with the CDC staff in directing these courses. Industrial enterprises have found training courses such as these invaluable, and the U. S. Office of Education had extraordinary success in administering them during the war.

Now, let us briefly glance at the United States as a whole and see how, by utilizing previously mentioned principles and procedures, the field training centers which constitute the nucleus for a national program are distributed across the Nation. We shall start in the East and move first to the South and then to the West.

Amherst, Mass.—Regional field training center serving New England.

Buffalo, Syracuse, and Albany, N. Y.—Regional field training center and assistance to State health department training office.

Pittsburgh and Harrisburg, Pa.—Regional field training center and assistance to State health department training office.

Cincinnati, Ohio.—Nation-wide field training center in environmental sanitation, stream pollution control, and radiological health.

Bloomington, Ill.—Regional field training center.

Charleston and Columbia, S. C.—Field training center and assistance to State health department training office.

Chapel Hill, University of North Carolina, School of Public Health.—Assistance to university field training team of State and regional scope.

Atlanta, Ga.—Headquarters of training services.

Columbus, Ga.—Regional field training center.

Topeka, Kans.—Regional field training center.

Norman, Okla.—Field training center and assistance to State health department training office.

Denver, Colo.—Regional field training center.

San Francisco, Calif.—Assistance to State health department training office.

Seattle, Wash.—Regional field training center and assistance to State health department training office.

It is possible to comment upon only two or three examples of these centers and to indicate briefly their scope and development.

New York Field Training Center Productive Three Ways

Approximately 3 years ago, two Public Health Service officers were assigned to the Troy-Rensselear Health Department under an agreement with the New York State Health Department. They had been engaged for a year or more at Columbus, Ga., in field training courses in environmental sanitation, in which county sanitarians from North Carolina, South Carolina, and Georgia were given 3 months of practical training. In addition to conducting the 12-week regularly scheduled courses for New York State sanitary inspectors, the two

Public Health Service officers developed, upon request, decentralized training activities of different types for the University of Massachusetts at Amherst and for Pittsburgh, Pa. It was found that their help was beneficial, and the time proved ripe for developing field training in both Massachusetts (for the six States in the New England area) and in Pennsylvania, as well as for expanding the excellent but limited field training activities in New York State. Thus, from the original Troy field training demonstration, there have grown three comprehensive training programs: (1) the New England field training center; (2) the development of more complete systems of field training for all public health disciplines in New York State; and (3) full-time field training activities to serve Pittsburgh and the State of Pennsylvania.

New England Field Training Center

Utilizing the resources and facilities at the University of Massachusetts, after an agreement by the State, the Federal Security Agency Regional Office, and the university, two CDC training officers were assigned to Amherst. Instead of sending the University's 4-year graduates in environmental sanitation to Michigan as had been done in the past, facilities were developed and put into use in western Massachusetts. The field training demonstration was successful from the start. Later, Kellogg Foundation assistance, together with funds from the State health department and the university, made it possible to inaugurate a full-fledged Massachusetts field training program, with responsibility resting in the executive office of the State health commissioner. The leadership and enthusiasm of the director of training have moved the program rapidly forward, and it is proposed to have this center serve all New England for the field training of all types of public health workers.

Expansion of New York State Training Program

With the assistance of Public Health Service officers, the office of professional training at Albany has embarked upon a program of giving field training to sanitary engineers and sanitarians on a State-wide basis. The report, dated March 12, 1951, of the Committee on Sanitation Training to the health commissioner, Dr. Herman E. Hilleboe, recommended inauguration of three types of training program: short in-service training courses for all engineers and sanitarians; internship training program for inexperienced engineers and sanitarians; and formal academic training for engineers and sanitarians at universities and colleges. The report also recommended that a public health engineer and sanitarian be employed to operate and supervise the training section and direct all sanitation programs in the State. The necessary funds and personnel, it is reported, have been obtained by New York to make this training program effective.

New York is also expanding field training for health educators and health officers through assignment of training officers.

Inauguration of Field Training in Pennsylvania

The enthusiastic interest of the director of the new School of Public Health in Pittsburgh, of the new State health commissioner, and of the health officer of Pittsburgh have stimulated progress in field training in Pennsylvania. The Public Health Service assigned two training officers with broad experience to the new regional center which the city health department provided and equipped. Twelve-week courses in environmental sanitation for trainees from Pittsburgh, from Pennsylvania Health Department headquarters, and from Ohio are meeting with success.

At the request of the new State health commissioner, the scope of the field training is being broadened by establishing a director of training in the executive office of the commissioner for the purpose of assisting all divisions in training public health personnel. Our training officer has been invited to assist in the work.

This brief recital of the trend toward enlarging field training in the northeastern section of the country indicates how ready the States are to cooperate in more effective training activities. The demonstration at Troy, N. Y., bore fruit far out of proportion to the investment made by CDC.

Specialized Training Services at Cincinnati

Close liaison is maintained between two field stations of the Public Health Service: the Communicable Disease Center and the Environmental Health Center at Cincinnati, Ohio. As Atlanta headquarters provides Nation-wide services in field training through regional centers, the Environmental Health Center provides specialized training along three lines: (a) stream pollution control; (b) laboratory aspects of milk and food; and (c) radiological health.

An increasing amount of research in connection with industrial wastes disposal, industrial hygiene, water supply, sewage wastes disposal, and radiological projects makes Cincinnati the logical training center to give help to States through specialized courses. A competent staff of training officers, consisting of sanitary engineers, chemists, bacteriologists, and biologists, organize and give these courses.

During 1950, a staff in radiological health was assembled at Cincinnati under the direction of the Radiological Health Unit, Division of Engineering Resources, in Washington. Leaders from State health departments are welcomed to these 2- to 3-week courses which acquaint the trainee with the various aspects of radiological health in relation to water supply and wastes disposal.

Research laboratory activities in milk and food bacteriology afford an opportunity to develop short courses to assist State laboratory personnel in food and milk sanitation.

The courses scheduled at the Environmental Health Center are developed and directed entirely by the Cincinnati and Washington offices of the Public Health Service, but close liaison is maintained with the CDC Training Services so that the training courses can be incorporated into the published training schedules of the Public Health Service and essential teaching aids can be developed in the categories in which the Cincinnati Training Center specializes.

Contributions from Educational Agencies

Schools of Public Health, universities, and foundations have offered, perhaps, the most stimulation in the improvement of field training methods. In Massachusetts, New York, North Carolina, Pennsylvania, Colorado, Michigan, Illinois, and Oklahoma, contributions have been too numerous to mention. Deans of schools of public health and the Kellogg Foundation have made it possible to hold two outstanding work conferences; the first at Chapel Hill, N. C., in June 1950; the second at Battle Creek, Mich., in April 1951.

The Training Services has noted with interest five recommendations of a committee report developed at the Chapel Hill meeting, relating to the kinds of help which the Public Health Service might give to assist the Nation-wide effort in field training. The recommendations were:

1. To make financial grants available to States for the development and continued support of field training programs.
2. To train field training specialists and to lend them to States to assist in the development and conduct of training programs. Some of these specialists might comprise teams for highly specialized training activities.
3. To develop and make available to States various training materials, such as manuals, visual aids, models, and exhibits.
4. To assist in the development of regional field training programs for areas where individual State programs are not feasible.
5. To serve as research centers for the development of field training techniques.

Participating in this successful Nation-wide working conference were 29 field training officers, and representatives from 13 States, the Public Health Service, the W. K. Kellogg Foundation, the University of North Carolina School of Public Health, and the University of Massachusetts. At a second Nation-wide conference in Battle Creek, Mich., made possible through the Kellogg Foundation, directors of departments handling courses in undergraduate environmental sanitation in universities and schools throughout the country assembled

for a week's work session. The result was substantial agreement upon the curricula for the 4-year courses in environmental sanitation. One point was unanimously agreed upon, namely, that 3 months of field training is a "must" in the educational program of a competent sanitarian.

Training Program Useful in World-Wide Public Health

It is fortunate that the Public Health Service has been developing these field training facilities. Not only are they becoming increasingly useful to the States but they are also proving of value in our international relationships. Every year more than a hundred public health administrators and students from other countries visit and participate in field training at CDC headquarters at the completion of their university study.

The Public Health Service is assigning scores of its medical, nursing, engineering, and scientist officers to the ECA Technical Missions program in southeast Asia. The facilities in Georgia and adjacent States for field training in malaria control, insect and rodent control, basic sanitation, and for learning public health administration techniques, are being put to effective use. In May, 50 Public Health Service officers completed a 4-week period of field training in Atlanta before leaving for the different countries in southeast Asia to teach, to guide, and to demonstrate more effective methods of controlling disease.

CDC training officers are working closely with the Division of International Health in Washington to the end that regional field training facilities in other countries may be patterned after the program described herein—a program which can be summed up as "learning by doing."

An Unusual Enteric Pathogen

By Erich Seligmann, M.D., and Ivan Saphra, M.D.*

The enteric pathogen to be described was isolated in the laboratory of the Brooklyn Jewish Hospital by F. B. Traub from the feces and the blood stream of an 8-month-old male baby suffering from a protracted course of low fever, diarrhea, and malaise. The cultural and serological qualities of the strain put it in-between the *Salmonella* and the paracolon group of enteric bacilli. It is a gram-negative, motile rod, forming acid and gas from dextrose, mannite, and maltose within 24 hours. It promptly ferments sorbitol, arabinose, xylose, rhamnose, and trehalose. No citrate is utilized; H_2S is formed abundantly; indol and urea cleavage are negative. It does not attack dulcitol, inosite, d-tartrate, adonitol, mucate, and salicin. Lactose and sucrose are not acidified within 25 days. Gelatin is liquefied after 2 months. M. R.+V. P.−

Gelatin liquefaction is no longer a differential criterion. Kauffmann enumerates in his manual (*1*) no less than 17 *Salmonella* types capable of liquefying gelatin. Dulcitol fermentation, although characteristic for a great number of *Salmonella*, may be missing in this group (*SS. cholerae suis*, *pullorum*, variants of *SS. typhi* and *paratyphi B*, *sendai*, etc.). The utilization of d-tartrate, often indicative of *Salmonella* types, is not performed by quite a number of types of all groups. Mucate may or may not be fermented by *Salmonella*, although as a rule it is attacked by the members of the paracolon group. Altogether, the fermentation reactions of our organism are close to those of typical *Salmonella* strains except for a fecal odor emanating from the culture.

The O antigen is not identical with any of the known *Salmonella* antigens. It corresponds, however, with that of Arizona paracolon S39.[1] Reciprocal agglutinin absorption proved its complete identity. The H antigen belongs to the z_4 . . . group. This H group combined with different other partial antigens (z_{23}, z_{24}, z_{25}, z_{26}, z_{32}) is represented in the *Salmonella* group as well as in the Arizona paracolon group. Detailed examination of the strain with numerous agglutination and absorption tests identified the H antigen as z_4 z_{32}. So far this pattern has only been found in one member of the *Salmonella*

*Division of Laboratories, Beth Israel Hospital, New York City.

[1] We are indebted to Dr. P. R. Edwards who drew our attention to this fact and provided us with S39 culture and antiserum.

group, *S. tallahassee* (VI, VIII: z_4 z_{32}). The serological structure of the strain might easily be described in *Salmonella* terminology, using a new O symbol. It could also be described readily in paracolon terminology with the help of the symbols presented by Edwards and collaborators (*2*). The strain was pathogenic for man. It was isolated from the blood stream and feces of a sick infant.

All *Salmonella* are considered pathogenic for man and/or animals. On the other hand, paracolon and coliform organisms have been encountered as potential pathogens in ever increasing frequency. Thus, pathogenicity cannot be relied upon as a differentiating characteristic of the groups. Apparently, the strain presents a parallel to those recently described by Edwards and West (*3*). It is a culture intermediate between *Salmonella* and paracolon which does not easily fit into either group, and thus is another example of the evolutionary trend in the family of Enterobacteriaceae.

REFERENCES

(*1*) Kauffmann, F.: The Diagnosis of Salmonella Types. Charles C. Thomas, Springfield, Ill., 1950.

(*2*) Edwards, P. R., West, M. G., and Bruner, D. W.: Arizona Group of Paracolon Bacteria. Bull. 499 Kentucky Agric. Exper. Station, Lexington, 1947.

(*3*) Edwards, P. R., and West, M. G.: Unusual types of enteric bacteria. J. Infect. Dis. **87**: 184 (1950).

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended September 29, 1951

Two of the three cases of diphtheria reported in California for the week occurred in one household. The contacts broke quarantine and migrated to at least three other counties in the State. One suspected clinical case has been found in these groups of migratory workers. The first information on the original cases was obtained in a follow-up of a positive laboratory report.

The numbers of cases of malaria among civilians and from military establishments for the current week showed no significant change over the numbers reported during the previous 4 weeks. Of the 43 cases in civilians reported, 27 were in Wisconsin and 7 in Texas.

There was a substantial decrease in the number of poliomyelitis cases reported for the current week (1,405) as compared with the previous week (1,746) and the same week last year (1,990). The cumulative total for the calendar year is 20,505 as compared with 21,528 for the same period last year; and the cumulative total since the seasonal low week is 19,293. For the same period in 1950, there were 20,397 cases.

All geographical regions except two reported decreases for the current week. Only the New England and South Atlantic States reported increases as compared with the previous week, and in each instance the increase was slight.

The largest number of poliomyelitis cases reported in any 1 week, the peak week, in the New England States was for the week ended August 11; the week ended August 18 in the West South Central States; August 25 in the East South Central and Mountain regions; September 1 in the South Atlantic; September 8 in the Middle Atlantic; September 15 in the West North Central; and September 22 in the East North Central and Pacific States. In 1950 only one region had its peak week prior to the week ended September 9, in contrast to five, as noted above, in 1951.

Typhoid Fever

An epidemiological report of 15 cases of typhoid fever which occurred in California in August reveals that there were two instances of multiple cases in the household. Four cases occurred in one family and two in another. Nine of the 15 cases were considered to have been infected out of the State, and in only one instance was a carrier found in the household. The incidence of typhoid fever in California appears to have been higher this year than last.

Dr. W. L. Bierring, Iowa Commissioner of Health, states that typhoid fever incidence was greater in the period from January 1 to September 15, 1951 (19 cases) as compared with the same period last year (9 cases). Two of the 19 cases lived in flooded areas, but proof is lacking that flood conditions were responsible. No carrier sources were found in these cases. However, 5 of the 15 cases had a definite carrier source, and in 2 other cases still under investigation there is a probability of carrier infection.

Dr. B. G. Hamilton, Missouri Director of Health, has reported four cases of typhoid fever in Perry County with onset in late August. A common source of infection has not been found. Only one case was culturally positive. Other cases are under investigation.

Schistosomiasis

Dr. Dean Roberts, Maryland Department of Health, reports that following the diagnosis of *Schistosoma mansoni* infection in a Puerto Rican laborer in Carroll County, laboratory examinations of the stools of 32 other workers were carried out. Thirty-one had *Trichuris trichirua,* 24 had hookworm, 10 had *S. mansoni,* 5 had *Strongyloides stercoralis* (larvae), 3 had *Giardia lamblia,* 3 had *Endolimax nana,* and 1 had *Endomoeba histolytica.*

Gastroenteritis

Dr. J. C. Hart, Connecticut Department of Health, has reported an outbreak of gastroenteritis in a boarding school, following a turkey dinner served to students and faculty members and their families. After an incubation period of 7 to 18 hours, 19 students reported to the infirmary with abdominal pain and diarrhea. In the investigation by Dr. M. E. Rindge, it was found that approximately one-half of those partaking of the dinner were mildy ill. The turkey had been cooked the day before serving, refrigerated overnight, but kept at room temperature several hours after slicing. An organism of the paracolon group was isolated from leftover turkey meat.

Dr. R. F. McAteer, Rhode Island Department of Health, reports a

family outbreak of *Salmonella* infection in three of five members in which ham hash is suspected of being the vehicle of infection. The incubation period was reported to vary from 2 to 5 hours. A group B. *Salmonella* organism has been recovered. *Salmonella schottmulleri* was isolated from an infant, not related to the other cases, at about the same time. A contact carried the same organism.

Dr. W. R. Giedt, Washington State Department of Health, has reported an outbreak of food poisoning following a picnic in Yakima attended by about 300 persons on September 16. About 230 persons became ill, the onset ranging between 1½ and 3 hours after eating the picnic luncheon. The food item found responsible for the illness was baked, tenderized ham, contaminated with *Staphylococcus aureus*. The ham was baked Thursday and remained unrefrigerated until served on Sunday.

Dr. H. M. Erickson, Oregon State Health Officer, has reported an outbreak of food poisoning among children eating in an elementary school cafeteria. There were 55 cases among 131 persons who ate butterscotch pudding which had been kept at room temperature for nearly 24 hours prior to serving. *Staphylococcus aureus* was isolated from a specimen of the pudding.

Dr. M. H. Merrill, California Department of Public Health, has reported an outbreak of food poisoning in a rural penal camp. Nausea and vomiting occurred in 49 persons 1 to 3 hours after eating fried liver. Five cases were ill for several days. The liver was reported

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Sept. 29, 1951	Sept. 30, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	1	1	1	(1)	(1)	(1)	(1)	47	33	41
Diphtheria (055)	100	131	252	27th	713	1,021	1,792	2,721	4,149	6,402
Encephalitis, acute infectious (082)	30	28	32	(1)	(1)	(1)	(1)	796	707	497
Influenza (480–483)	360	463	463	30th	2,649	3,402	3,402	118,704	142,166	131,394
Measles (085)	863	667	667	35th	[2] 3,423	2,225	2,225	[2] 473,334	290,396	554,446
Meningitis, meningococcal (057.0)	56	62	54	37th	106	113	102	3,167	2,912	2,727
Pneumonia (490–493)	434	689	(3)	(1)	(1)	(1)	(1)	48,695	64,856	(3)
Poliomyelitis, acute (080)	1,405	1,990	1,528	11th	[4] 19,293	20,397	18,824	[4] 20,505	21,528	19,174
Rocky Mountain spotted fever (104)	8	1	10	(1)	(1)	(1)	(1)	297	422	505
Scarlet fever (050) [5]	491	474	586	32d	2,185	2,331	3,032	55,571	42,501	60,032
Smallpox (084)	------	------	------	35th	11	------	2	11	26	51
Tularemia (059)	7	13	13	(1)	(1)	(1)	(1)	[6] 512	734	763
Typhoid and paratyphoid fever (040, 041) [7]	96	90	109	11th	1,922	2,168	2,478	2,357	2,678	2,963
Whooping cough (056)	987	1,630	1,630	39th	75,377	118,731	101,893	53,775	97,195	75,875

[1] Not computed. [2] Deduction: North Carolina, week ended June 16, 1 case. [3] Data not available. [4] Deduction: Arkansas, week ended September 8, 1 case. [5] Including cases reported as streptococcal sore throat. [6] Deduction: Arkansas, week ended Aug. 18, 1 case. [7] Including cases reported as salmonellosis.

to be green in color, bitter, and friable. Refrigeration was found to be inadequate at the camp.

Anthrax in Animals

Dr. L. R. Davenport, Illinois Department of Public Health, reports that four outbreaks of anthrax have occurred in Illinois over the past few weeks. Two outbreaks occurred in cattle and two in swine. The most recent outbreak disclosed the loss of 35 swine on a farm in the southwestern part of the State. The source of the outbreaks is unknown, but mention is made of the occurrence of the disease in Kentucky, Tennessee, and Missouri prior to that in Illinois. No human cases have been reported in the latter State.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Sept. 29, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**100**	**30**	**360**	**863**	**56**	**434**	**1,405**
New England	**1**		**2**	**126**	**2**	**21**	**40**
Maine			1	18		5	2
New Hampshire				7	1		1
Vermont				22			5
Massachusetts	1			55			12
Rhode Island				17		1	
Connecticut			1	7	1	15	20
Middle Atlantic	**8**	**9**	**1**	**242**	**18**	**57**	**177**
New York	5	7	(1)	112	6		97
New Jersey		2	1	56	5	25	20
Pennsylvania	3			74	7	32	60
East North Central	**4**	**2**	**1**	**167**	**5**	**58**	**367**
Ohio	1			32			64
Indiana	2	1		2		2	34
Illinois				48	1	36	111
Michigan			1	25	3	20	64
Wisconsin	1	1		60	1		94
West North Central	**3**	**3**		**34**	**5**	**38**	**160**
Minnesota	1			3	4	4	28
Iowa		1		6		10	23
Missouri				2	1	1	42
North Dakota		1		11		19	
South Dakota				6			7
Nebraska	1	1		1			20
Kansas	1			5		4	40
South Atlantic	**34**	**2**	**148**	**71**	**6**	**67**	**90**
Delaware							
Maryland	1			27		19	7
District of Columbia				3		13	3
Virginia	2		133	15		27	14
West Virginia					1		16
North Carolina	16	2		9	4		16
South Carolina	11		5	2		6	1
Georgia	4		10	13		2	29
Florida				2	1		4
East South Central	**32**	**4**		**24**	**9**	**20**	**114**
Kentucky	9			1	2	8	10
Tennessee	7			9	5		40
Alabama	9	3		5	1	4	27
Mississippi	7	1		9	1	8	37
West South Central	**12**	**2**	**79**	**32**	**3**	**99**	**141**
Arkansas	3		48			14	19
Louisiana	1		1			8	37
Oklahoma	1	1	30	2		4	19
Texas	7	1		30	3	73	66
Mountain	**3**		**99**	**62**	**2**	**28**	**103**
Montana	2		5	6			15
Idaho				5			2
Wyoming							14
Colorado			3	11	2	7	34
New Mexico				2		2	6
Arizona			91	30		19	3
Utah	1			8			27
Nevada							2
Pacific	**3**	**8**	**30**	**105**	**6**	**46**	**213**
Washington			6	11	2		32
Oregon			21	35	1	12	19
California	3	8	3	59	3	34	162
Alaska					1		2
Hawaii				44		1	

[1] New York City only.
Anthrax: Arkansas, 1 case.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Sept. 29, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	8	491		7	96	987	123
New England		28			3	76	
Maine		1			1	9	
New Hampshire		1				7	
Vermont						1	
Massachusetts		22			2	53	
Rhode Island		3				1	
Connecticut		1				5	
Middle Atlantic	2	71			4	182	11
New York		27			2	77	10
New Jersey	1	17			1	39	
Pennsylvania	1	27			1	66	1
East North Central		125		1	11	223	8
Ohio		28			6	36	6
Indiana		11			1	13	2
Illinois		33		1	4	53	
Michigan		37				60	
Wisconsin		16				61	
West North Central		32			6	29	7
Minnesota		8					4
Iowa		4			3	2	
Missouri		4			2	16	3
North Dakota		3					
South Dakota					1	3	
Nebraska		7				3	
Kansas		6				5	
South Atlantic	4	91			15	75	11
Delaware							
Maryland		6			3	4	
District of Columbia		4				4	
Virginia	2	9			1	12	2
West Virginia		20			1	5	
North Carolina	2	39			1	37	
South Carolina		2			1	5	7
Georgia		4			8		2
Florida		7				8	
East South Central	1	53		1	18	52	29
Kentucky		14			3	20	13
Tennessee		24			4	17	6
Alabama		12			2	10	3
Mississippi	1	3		1	9	5	7
West South Central		10			21	224	57
Arkansas		3			2	35	4
Louisiana					6	1	26
Oklahoma		2			3	18	1
Texas		5			10	170	26
Mountain	1	4		5	9	45	
Montana					1	3	
Idaho		4				4	
Wyoming				4		1	
Colorado					3	13	
New Mexico					2	2	
Arizona					3	22	
Utah	1			1			
Nevada							
Pacific		77			9	81	
Washington		9			2	9	
Oregon		13				2	
California		55			7	70	
Alaska						21	
Hawaii							

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Sept. 15, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	1						1				
Chickenpox	192			7		28	62	18	11	39	27
Diphtheria	1					1					
Dysentery:											
Amebic	1				1						
Bacillary	9					5					4
German measles	84			10		20	12		8	14	20
Influenza	14			7			5	1			1
Measles	247	4		23	2	83	29	10	12	49	35
Meningitis, meningococcal	5	1				1		1	1	1	
Mumps	132			2		12	68	9	2	16	23
Poliomyelitis	165			16	5	18	110	3	8	2	3
Scarlet fever	139			1		38	13	21	13	23	30
Tuberculosis (all forms)	251	7		1	4	150	6	25	6	15	37
Typhoid and paratyphoid fever	6	1			2	1	1			1	
Venereal diseases:											
Gonorrhea	341	4		3	10	84	60	29	35	41	75
Syphilis	71	2		4	3	38	9	1	6	5	3
Primary	3			1		2					
Secondary	6					2	1		2	1	
Other	62	2		3	3	34	8	1	4	4	3
Whooping cough	187			4		26	70	18	13	21	35

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Cholera

Burma. The flare-up of cholera in Tavoy seems to be under control since only three cases were reported for the week ended September 22, 1951, as compared with 10 for the previous week.

India. The outbreak of cholera in Madras which began about the first of September has now reached 436 cases for the first 3 weeks of the month. This is more than the total number (420) reported for the year up to September 1. For the week ended September 22, cholera was reported in India as follows: Madras, 181 cases; Calcutta, 33; and Cawnpore, 1.

Indochina. One case of cholera occurred in the rural area near Soc Trang, Viet Nam, during the week ended September 22. Three other cases were reported earlier in the port of Soc Trang, the last previous case being for the week ended June 16.

Plague

Belgian Congo. One case of pneumonic plague was reported north of Lubero in Ndekoluoku, District of Kivu, Costermansville Province, on September 25, 1951. Another case was reported in this province for the week ended September 1.

Burma. The first cases (2) of plague during 1951 were reported in Moulmein for the week ended September 8.

Smallpox

India. During the week ended September 22, 1951, smallpox was reported in ports as follows: Madras, 18 cases; Calcutta, 4; Negapatam, 3; and Vizagapatam, 2.

India (French). The incidence of smallpox decreased from 40 cases for the period August 21–31 to 11 for the following 10-day period. In Karikal the decrease was from 21 cases to 3 for the same periods.

Typhus Fever

France. For the week ended September 8, 1951, one case of typhus fever was reported in Paris.

Germany. During the week ended September 1, 13 cases of typhus fever were reported in the French Sector of Berlin. Only one other case has been reported for the year in this area.

Turkey. Three cases of typhus fever were reported in Turkey, one in Istanbul and two in Izmir.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON D. C. : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
Price 15 cents. Subscription price $4.75 a year. $6.25 foreign.

Public Health Reports

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FEDERAL SECURITY AGENCY
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Public Health Reports

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Dental Practice in Western Pennsylvania

By Antonio Ciocco, D.Sc., Isidore Altman, M.S., and Isaac Sissman, D.D.S.*

The recent estimates made by the Health Resources Advisory Committee of the National Security Resources Board (now of the Office of Defense Mobilization) regarding the requirements for dentists in a period of mobilization are based on the assumption that it will be necessary to maintain the 1949 ratio of dentists to population while meeting military and mobilization needs (*1*). The Odontological Society of Western Pennsylvania, to test the validity of the underlying assumption that the supply and effective demand for dentists' services are in equilibrium for this area, has queried local dentists concerning their patient load and their capacity to increase it.

At the request of the society, the Department of Biostatistics of the Graduate School of Public Health, University of Pittsburgh, assisted in the preparation of a questionnaire and analyzed the returns.

Although this study had a limited objective, namely, to determine the ability of dentists in this area to assume additional patients, we feel that it illustrates how probing for facts will save much time and energy in the discussion of such controversial points as the oversupply or shortage of dentists and other health personnel. This study was not planned to obtain information on the broader issues of long-term supply and demand problems, but it should point out that there are ways and means of getting such information provided there is willingness to do so.

Material and Method

A questionnaire was sent to approximately 1,500 dentists—some 1,200 of whom were members of the Odontological Society—practicing in the nine counties covered by the society: Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Washington, and

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*Head, Department of Biostatistics, Graduate School of Public Health, University of Pittsburgh, Biostatistician, Division of Public Health Methods, Public Health Service, and Editor, Bulletin of the Odontological Society of Western Pennsylvania, respectively.

Note: This report is also appearing in the October 1951 issue of the Pennsylvania Dental Journal, vol. 18, pp. 191–199.

Westmoreland. This area contains more than 2,700,000 persons according to the 1950 census.

The questionnaire covered the week of May 7–13, 1951 (see sample form). It asked first for the hours in the office during the week, at chairside, in the laboratory, and other work, and number of free hours. Other questions asked for hours in professional activities outside the office and for the total number of visits by patients. Important questions on additional patients were:

"Could you have seen more patients without reducing the quality or quantity of services rendered to the patients that were seen? If yes, how many more?"

In an allied question, the dentist was asked how soon he could see new patients—in 1 week, 2 weeks, a month, or not at all within this period.

The remaining questions covered items with which the answers to the above questions were likely to be associated—employment of assistants or hygienists, number of dental chairs, place of practice, year of birth, and whether the dentist was in general or special practice.

ODONTOLOGICAL SOCIETY OF WESTERN PENNSYLVANIA

Mobilization and Defense Manpower Studies

For the week May 7–May 13, inclusive, please answer the following questions:

1. How many hours of the week did you spend in the office?
   (a) Total ------------
   (b) At the chair treating patients ------------
   (c) In the laboratory ------------
   (d) On other work ------------
   (e) Number of free hours ------------
2. How many hours did you spend in professional activities outside the office?
   (a) clinic ------------ (c) other (specify) ------------
   (b) teaching ------------
3. What was the total number of visits by patients? ------------
4. (a) Could you have seen more patients without reducing the quality or quantity of services rendered to the patients that were seen? ------------
   If yes, how many more? ------------
   (b) If calls by new patients (nonemergency) warranted, would you spend more time in the office? ------------
   If yes, how many additional hours per week? ------------

* * * * *

5. (a) Do you employ a dental assistant? Number ------------
   (b) Do you employ a dental hygienist? Number ------------
6. How many dental chairs are used by you and your auxiliary personnel (excluding other dentists)? ------------
7. If a new patient (nonemergency) called for an appointment, could you see him (check one):
   Within 1 week ☐ Within a month ☐
   Within 2 weeks ☐ Could not see patient within month ☐
8. Place of practice (check one):
   (a) If Allegheny County:
      (1) Office building in Downtown, Oakland or East Liberty ☐
      (2) Elsewhere in Pittsburgh ☐
      (3) Outside of Pittsburgh ☐
   (b) Other than Allegheny County:
      (1) Community of less than 5,000 population ☐
      (2) 5,000–10,000 population ☐
      (3) 10,000–25,000 population ☐
      (4) Over 25,000 population ☐
9. (a) Year of birth ------------ (b) Years in practice ------------
10. Comments ------------
11. Are you in general practice ☐ In a specialty ☐

Sample questionnaire

To preserve anonymity and induce a greater response, signatures were not requested of the respondents. This makes possible only a rough estimate of the representativeness of the 632 dentists who replied. If we suppose that the replies came principally from the 1,200 members practicing in the area, we can say that about 50 percent of the membership in active private practice filled out and returned the questionnaire. In the light of other experiences with mailed questionnaires, this can be considered a high rate of return.

Distribution by age and by place of practice of the dentists who received the questionnaire and of the 632 who replied, are given in table 1. Succeeding data are based on somewhat smaller numbers, depending on how many dentists supplied information on the particular question.

Table 1. *Percentage distribution of all dentists in area and of dentists replying to questionnaire*

Dentists	By age (years)						
	Under 35	35–44	45–54	55–64	65 and over	Total	Number dentists
Receiving questionnaire	9.0	17.4	41.3	18.7	13.6	100.0	[1] 1,485
Replying to questionnaire	12.7	21.8	43.8	14.6	7.1	100.0	632
	By geographic distribution						
	Allegheny County		Other than Allegheny County (population)				Total
	Pitts-burgh office buildings	Else-where in the county	Over 25,000	10,000–25,000	5,000–10,000	5,000 or less	
Receiving questionnaire	22.9	44.0	4.6	13.6	7.1	7.8	100.0
Replying to questionnaire	22.1	43.2	4.8	16.9	6.1	6.9	100.0

[1] Distribution based on 1,394 dentists of known age.

The age distribution of the replying dentists compares favorably with that of the total profession, although there were more young men and fewer older men in the replying group. This greater tendency on the part of the younger men to reply was also observed in the 1950 Survey of the Dental Profession (*2*).

The percentage distribution of replies by place of practice corresponds closely with that of the profession: 66.9 percent of the practitioners in this area are in Allegheny County while 65.3 percent of the replies came from there. The distinction between inside and outside Pittsburgh shown on the questionnaire cannot be used here for analysis because the lists of the dental society are maintained on a postal zone basis which covers many units politically independent of Pittsburgh proper.

Characteristics of Practice

We are mainly concerned here with questions related to the ability or willingness of dentists to increase their patient load. But first, certain general characteristics of practice in this part of the State will be described and compared with the findings of the American Dental Association 1950 Survey of the Dental Profession.

In the latter study, a far lengthier questionnaire than the one employed here was sent to a sample of 20,000 dentists throughout the country. Replies were received from more than 4,000, or better than 20 percent. The week for which the dentists were asked to supply data was April 16–22, 1950. This is comparable seasonally to the date May 7–13 of the present study.

Both studies show a marked similarity in the average number of hours spent in the office during the week and the hours at chairside and other activities (table 2). The pattern of how much time dentists devote to the office and to activities within the office is apparently the same, and it is doubtful that the slightly greater time noted by western Pennsylvania dentists is really meaningful. There was little variation within the present study from one type of community or place of practice to another.

The findings of both these studies are similar to those of Klein (*3*) who found that in February 1942 dentists spent 46.9 hours a week in the office, 34.3 hours of which were spent at the chair. By the corresponding week in 1943, when a substantial number of dentists had joined the armed forces, civilian dentists were spending 50.0 hours in the office and 37.7 hours at the chair.

A complementary question in the study reported here, which was not included in the ADA survey, concerned the dentist's professional activities outside the office, that is, in clinical work, teaching, or other pursuits. The average amount of time per dentist proved to be rather small: 1.2 hours in clinical work at schools and hospitals, 0.8 hour in teaching, and 0.5 hour attending meetings, postgraduate courses, and the like. However, a small number of practicing dentists devote a considerable amount of time to outside work and teaching. One hundred twenty-eight dentists, 21.3 percent of the total, averaged 5.5

Table 2. *Average number of hours in office during 1 week by type of activity: Present study and ADA survey*

Activity	Present study	ADA survey
Total	43.9	42.2
At chair treating patients	34.5	33.0
Laboratory	4.9	3.8
Other work	1.0	2.2
Free hours	3.5	3.2

hours in outside clinical work during the week; 33 dentists, 5.5 percent of the total, reported an average of 14.3 hours in teaching.

If the findings of the ADA survey on the employment of ancillary personnel are representative of the profession as a whole, then the dentists of this area are somewhat deficient in this respect. Only 49 percent of them stated they employed assistants, and the dental hygienists reported were negligible; whereas in the ADA survey, 64 percent of the dentists reported they employed one or more assistants on a full-time basis, and 5 percent reported the employment of dental hygienists. About one-fourth of the western Pennsylvania dentists, usually from among those who employed an assistant, reported that they used more than one dental chair.

Number of Visits by Patients

Since only 31 of the replying dentists classified themselves as specialists, the data on patient load will be limited to general practitioners. Patient load is defined in this paper as number of visits or sittings.

The average number of patient visits reported was 57.0. This is similar to the findings in the ADA survey, 56.0, and to Klein's 1942 figure of 55.3. The variation in averages for different types of communities was, however, marked:

Community	*Average number of patient visits*
Allegheny County:	
Medical office buildings, Pittsburgh	45. 4
Elsewhere in Pittsburgh	60. 2
Outside of Pittsburgh	59. 8
Other than Allegheny County:	
25,000 and over	62. 7
10,000 to 25,000	59. 1
5,000 to 10,000	50. 3
Under 5,000	64. 6

The patient load for each age group was as follows:

Age of dentist (years)	*Patient visits*
Under 35	60. 0
35–44	63. 8
45–54	59. 0
55–64	44. 6
65 and over	31. 8

These age differences agree well with the findings of the ADA survey and with Klein. On the average, practicing dentists, and this is true of physicians as well, reach a peak in their patient load somewhere between the ages of 35 and 44. The decline that follows seems to be fairly rapid, a fact of extreme importance when the civilian welfare has to be considered in times of mobilization of the younger dentists.

The ADA survey found, as have other studies, that dentists who employ assistants or hygienists see more patients on the average than those who do not. Such was also the case here. Dentists employing auxiliary help saw 40 percent more patients than the group without employees. But which is cause and which is effect is hard to say. Does a dentist employ help because of the pressure of numbers of patients, or does the assistant make it possible for him to handle more people per unit of time and permit him to book more appointments? The answer may well be that both are true.

More patients were seen when the dentist had additional dental chairs. But no clear-cut interpretation of the findings can be made since the dentists who used more than one chair tended also to have assisting personnel.

Capacity To See More Patients

As previously indicated, the primary purpose of the study was to determine the situation which exists in this area with respect to the demand for dental services and the ability of practicing dentists to assume additional patients. That the answer has important implications for a policy on dental manpower with respect to defense and mobilization efforts goes without saying.

To the question whether more patients could have been seen during the study week, 233 of the general practitioners said yes and 339, no. (For brevity's sake, the two groups will be referred to as the Yes and No groups, respectively.) Thus, the majority, 60 percent of the dentists, indicated an inability to see additional patients. Forty percent of the dentists stated that they could have seen more patients "without reducing the quality or quantity of services rendered to the patients that were seen."

Proportionally, there were more dentists under 35 years and 55 years and over in the Yes group than in the No group. In terms of the respective age groups, 52 percent of all dentists under 35 years and 47 percent of the group 55 years and over said yes to the question. For the younger group, this percentage very likely reflects the difficul-

Table 3. *Percentage distribution by age of dentists who could see additional patients during study week and dentists who could not*

Age (years)	Could have seen more patients		Percent in age group who could see more patients
	Yes	No	
Under 35	15.9	10.0	52.1
35–44	20.2	24.8	35.9
45–54	41.6	47.8	37.5
55 and over	22.3	17.4	46.8
All ages	100.0	100.0	40.7
Number of dentists	233	339	572

ties confronting a beginning practitioner. In the older group, this answer may be a consequence of declining practice with increasing age. It the age groups, 35–54 years, 37 percent of the dentists said yes, while 63 percent could not see additional patients (table 3).

Table 4. *Percentage distribution by place of practice of dentists who could see additional patients during study week and dentists who could not*

Place of practice	Could see more patients		Percent in place of practice who could see more patients
	Yes	No	
Allegheny County:			
Medical office buildings, Pittsburgh	21.0	17.1	45.8
Elsewhere in Pittsburgh	20.6	16.5	46.2
Outside of Pittsburgh	28.8	26.0	43.2
Other than Allegheny County:			
25,000 and over	1.3	7.7	10.3
10,000 to 25,000	17.6	17.4	41.0
5,000 to 10,000	8.1	5.0	52.8
Under 5,000	2.6	10.3	14.6
All places	100.0	100.0	40.7
Number of dentists	233	339	572

The percentage in the Yes group was about the same throughout Allegheny County and in the middle-sized communities outside Allegheny County (table 4). These places account for all but about 12 percent of the dentists. The low percentages saying yes in the communities of 25,000 population and over and under 5,000 may be related to the higher patient load in these places.

As might be expected, the two groups differed with respect to other characteristics. The Yes group reported an average of 0.3 assistant and 1.2 chairs per dentist, while the No group had 0.6 assistant, or twice as many, and 1.3 chairs. The Yes group had an average of 7.9 free hours in the office during the study week while the No group reported only 0.7 hour. With respect to the question of how soon a new patient could be seen the results were:

Could see new patient within	*Percentage distribution*	
	Yes group	*No group*
1 week	87.1	23.6
2 weeks	11.6	38.3
Month	1.3	25.1
Could not see new patient within month	------	13.0
Total	100.0	100.0

The Yes group was on the whole consistent in its replies in that it clearly demonstrated its capacity and willingness to accept new patients. The No group was not as definite since 24 percent could see new patients within a week and 38 percent, within 2 weeks. On the other hand, 13 percent of them would not take new patients in

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a month, and 25 percent indicated that new patients would have to wait at least 2 weeks to a month.

There were differences in patient load between the Yes and No groups (table 5). Average number of patients seen by the No group, 67.5, was 63 percent greater than the number seen by the Yes group, 41.4. Similar disparities occurred in each of the age groups.

Table 5. *Comparison of patient load of dentists who could see additional patients in study week with those who could not*

Age of dentist (years)	Average number of patients, May 7–13		Ratio of No group to Yes group (=1)
	Dentists who could see more patients	Dentists who could not see more patients	
Under 35	42.8	78.8	1.84
35–44	45.9	72.8	1.59
45–54	44.8	67.8	1.51
55–64	32.1	56.7	1.77
65 and over	21.9	38.6	1.76
All ages	41.4	67.5	1.63

The chart illustrates the distribution of the two groups according to number of patients seen, that is, the number of dentists with specified patient load is presented for each group. The two distributions are quite distinct, and a statistical test (chi square) shows that the chance is less than one in a million that the two distributions could have come from the same universe of dentists.

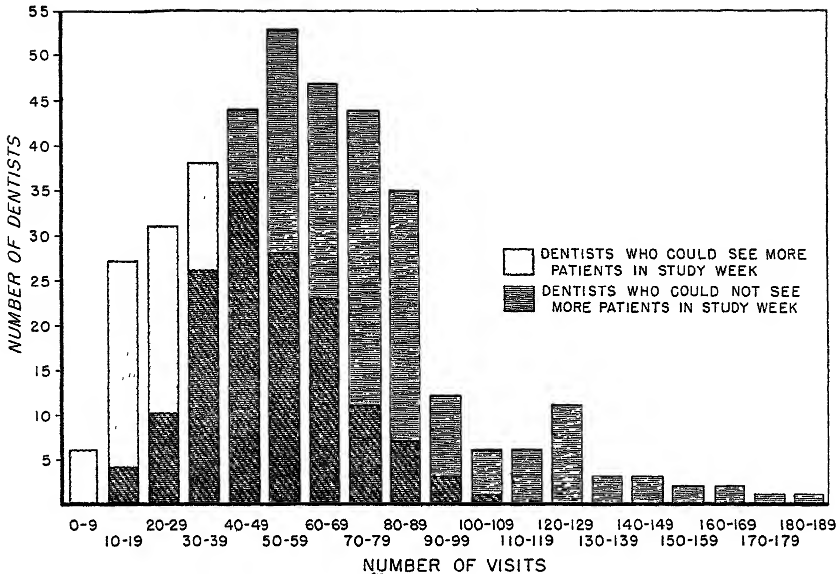
One interesting aspect of the two distributions is the overlap. Among dentists with the same patient load some indicated that they could not see more patients, others that they could. Among the dentists who said yes, 10.4 percent had patient loads equal to or higher than the average of those who said no. Among those who said no, 14.8 percent had a patient load equal to or less than the average of the dentists who said yes.

The dentists who had not achieved their maximum load were asked how many more patients they could take. The dentists in the Yes group to whom this question applied said that they could see, on the average, 15.4 more patients. This would mean for them a total of 56.8 patients in a week, which, it is important to observe, coincides with the over-all average of 57.0 patients.

Summary and Discussion

The major pertinent findings of this survey seem to be:

1. The average weekly patient load of dentists in western Pennsylvania in 1951 is substantially the same as that observed for the country as a whole in 1950. Fewer dentists in this area have dental assistants than in the country as a whole.



Distribution of dentists according to number of patients, western Pennsylvania, May 7–13, 1951.

2. Approximately 60 percent of the dentists state that they are working to their desired capacity. However, among dentists under 35 and above 55 years, the percentage is about 50.

3. The patient load of dentists who have achieved their desired capacity is about two-thirds higher than the patient load of those who have not.

4. The additional patients that could be seen by the dentists who have not achieved their desired maximum would bring their patient load to the average observed for western Pennsylvania.

Consideration of these findings leads, first, to the expected conclusion that, as all human beings, dentists differ in their behavior, including their capacity to work. Among general practitioners with about the same patient load, many considered themselves fully busy and many did not; a full quota for some is not necessarily a full quota for others. The basis of such differences in behavior is in itself deserving of study.

With regard to the main issue under discussion, the evidence seems to indicate that there is the same demand for dental services as is generally found in periods of prosperity. Furthermore, the present average weekly patient load of 57 visits is about the limit to which dentists who can see more patients are willing to go. The fact that 40 percent of the dentists are not working to capacity is apparently balanced by the high patient load of the remaining 60 percent.

The additional patients that the former said they could see would result in an increase of approximately 11 percent in the total number

of weekly patient visits now being handled by dentists.[1] This indicates that a rather narrow margin exists between the present situation, in which patients can obtain care with reasonable promptness, and one in which services would be delayed for weeks and even months. The latter situation would prevail were any appreciable increase in demand or withdrawal of dentists from civilian practice to take place. This is what we saw happen during the last war (*3*).

The above does not imply, however, that an increase in demand or withdrawal of dentists would provide additional patients for those dentists willing to see them. Dentists differ in performance and in ability to attract patients. The experience of the last war with respect to physicians indicates that the pattern of differences is little affected by a reduction in the number of practitioners. In time of maximum shortage there were physicians with few patients and physicians with many (*4*).

To summarize, the conclusion seems warranted that currently demand and supply of dental services in the Pittsburgh area are close to equilibrium. The balance is a delicate one which can be easily disturbed. Any appreciable withdrawal of dentists, who will primarily come from the younger groups, can be expected to place a burden upon the remaining dentists.

REFERENCES

(*1*) Schoeny, Leo J.: Dentistry, mobilization, and manpower. J. Am. Dent. Assoc. **42**: 548–557 (1951).

(*2*) American Dental Association, Bureau of Economic Research and Statistics. 1950 Survey of the Dental Profession. The Association, Chicago, 1951.

(*3*) Klein, Henry.: Civilian dentistry in wartime. J. Am. Dent. Assoc. **31**: 648–661 (1944).

(*4*) Ciocco, Antonio, and Altman, Isidore.: A postwar survey of physicians practicing in Washington. Med. Ann. District of Columbia **16**: 575–580 (1947).

[1] If the average of 57.0 patient visits holds for all the practitioners in this area, then there were some 84,645 visits during the study week to 1,485 dentists. If we apply to this total the finding that 40.7 percent of the general practitioners could see an average of 15.4 more patients, then 9,300 more patients could be seen. This represents 11 percent of 84,645.

Domestic Water and Dental Caries

VII. A Study of the Fluoride-Dental Caries Relationship in an Adult Population

By A. L. Russell, D.D.S., M.P.H., and Elias Elvove, Ph.D.*

Exhaustive studies of the fluoride-dental caries relationship in children have invariably demonstrated a marked inhibition of the disease in children who have always used a domestic water containing 1.0 part per million or more of fluorides. In adults, however, very few such studies have been reported and the findings are not in general agreement. Weaver concluded that fluoride ingestion had merely postponed the onset of dental caries by about 5 years in 100 young British mothers (*1*, *2*). Deatherage, on the contrary, observed caries-inhibitory effects which were still pronounced in Illinois males with a mean age of 25 years (*3*, *4*), while McKay, after a study of natives of Colorado Springs, concluded that "the inhibitory effect of fluoride, once acquired, is permanent" (*5*). Further study of the fluoride-dental caries relationship in representative adult populations seemed to be indicated.

The Study Cities

Colorado Springs, Colo., was selected for the present investigation, principally because of its long and reliable fluoride history. Nearby Boulder, Colo., was utilized as a control.

The populations of the two cities were 36,789 and 12,985, respectively, in 1940. Both lie in the semiarid plain at the eastern border of the Rocky Mountains, at altitudes of 6,098 and 5,404 feet. Since 1906 their average mean annual temperatures have been 48.1° and 50.6° and their mean annual precipitations, 14.8 and 18.9 inches, respectively; during this period the two weather stations have recorded about the same number of clear, partly cloudy, and cloudy days.

Native-born whites made up 98 percent of the Boulder population and 96 percent of the Colorado Springs population in both 1930 and 1940. Neither can be considered an aging nor a young population with respect to the other; both are highly literate. In general, workers in the two communities followed much the same occupations and earned about the same amounts in wages or salaries. Compared with the United States as a whole, the two communities depend for income

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rather more upon wholesale and retail trade, the professions, and services of various kinds, and sharply less upon manufacturing.

The Water Systems

The two water systems are essentially similar. In both, water is collected and stored in well-demarcated mountain watersheds and conveyed to reservoirs in or near the cities through closed pipeline systems. The pipelines and the underlying granites of the watersheds preclude the entry of ground water at any point. Except for the enlargement of storage facilities within the present watersheds, neither has been significantly altered since the summer of 1906, when both pipeline systems were put in operation.[1]

Colorado Springs Water System

An earlier report described the Colorado Springs water system in detail and summarized the epidemiological evidence that fluorine has been a constituent of Colorado Springs tap water for more than 50 years (*6*). Further evidence that a constant amount of fluoride has been present in Colorado Springs water for at least 44 years will be presented in this report. Twelve consecutive monthly samples of Colorado Springs tap water have twice been analyzed at the National Institutes of Health. Between November 1933 and October 1934 the mean annual level was 2.5 ppm of fluorides, with a high content of 3.0 ppm in February, March, and April and a low of 1.8 ppm in August (*7*). Between March of 1940 and February of 1941 a similar series of analyses showed a mean annual content of 2.55 ppm of fluorides, with a high level of 2.8 ppm in March and a low of 2.4 ppm in June and August (*6*).

The Boulder Water System

The only known fluoride deposit in the Boulder watershed is about 60 feet below the surface and is virtually inaccessible to water in the system itself (*8*, *9*). The entire watershed, comprising 19.3 square miles, is limited on the west by the Continental Divide and on the north and south by steep ridges varying in elevation from 11,100 to 13,515 feet. Its rocks are mainly pre-Cambrian schists and gneisses, with intrusions of tertiary granite and pegmatites (*8*). Water for winter use is stored in 11 mountain reservoirs which drain about 8.7 square miles of the watershed proper.

From these reservoirs the water flows for 17,800 feet through a pipeline into the Lakewood reservoir which, during the warmer months,

[1] Colorado Springs, in December of 1950, began to take about 2,000,000 gallons of water per day from Fountain Creek, which drains an area somewhat north of the present watershed. Clinical examinations were completed there during the following week. A sample of Fountain Creek water analyzed by Elvove in October 1944 contained 2.8 parts per million of fluorides.

drains the entire watershed; thence through 13.6 miles of pipeline to two reservoirs at the edge of the city; and finally into the distribution mains.

Twelve samples of Boulder tap water collected at monthly intervals between March of 1950 and February of 1951 have been analyzed for chemical content by Elvove. These findings are presented in table 1. Only trace amounts of fluoride were found, and these only in the samples collected in April, May, and August of 1950.

A sample of Boulder tap water analyzed by the same chemist in 1945 presented much the same composition.

Table 1. *Analyses of water samples from Boulder, Colo.*

Composition	Mar 1950	Apr. 1950	May 1950	June 1950	July 1950	Aug 1950	Sept 1950	Nov. 1950	Dec 1950	Jan. 1951	Feb. 1951	Mar. 1951
	Parts per million											
Total dissolved solids (103° C)	21.9	32 0	27 2	18 8	15 2	16 0	16.0	26 4	24 0	16.0	32 0	36 0
Loss on ignition	3 5	10 8	10 0	4.4	3 6	4.8	4.0	5 6	4 8	4.0	8 0	8 8
Fixed residue	18.4	21 2	17.2	14.4	11.6	11 2	12.0	20 8	19 2	12 0	24 0	27 2
Silica (SiO_2)	4 0	2.4	6 4	4.0	1 6	1 6	2 4	4 0	4 0	6 4	9 6	10.4
Iron (Fe)	.08	15	.22	.08	.03	08	.14	14	.12	.02	.10	08
Aluminum (Al)	02	0	.05	.01	0	0	01	.01	01	0	0	.02
Calcium (Ca)	4 6	4 6	4 6	2 3	2 3	2 3	2 3	4 0	3.4	1 7	4 0	4.0
Magnesium (Mg)	9	1.4	9	5	7	.7	7	9	7	5	1 2	1.2
Sodium and potassium (calculated as Na)	8	2 0	5	2 2	1 2	2	2	7	.3	2	2	.9
Carbonate (CO_3)	0	0	0	0	0	0	0	0	0	0	0	0
Bicarbonate (HCO_3)	19 5	20.7	15 9	12.2	12 2	9 8	9 8	12.2	12 2	4.9	17 1	17.1
Sulfate (SO_4)	2 9	1 2	2 1	2 2	2 5	1 6	2 5	1.2	3 3	2.5	3 3	2 9
Nitrate (NO_3)	.6	.3	.4	.4	3	2	3	.2	.2	2	.3	.2
Chloride (Cl)	1	1	.2	.1	1	1	1	.1	1	.1	.1	.2
Phosphate (PO_4)	0	0	0	0	0	0	0	0	0	0	0	0
Fluoride (F)	0	.1	.1	0	0	.1	0	0	0	0	0	0

Assembly of Examination Lists

The examination lists were based upon school census records, birth records, marriage records, and city directories; the same compilation procedure was followed in both cities. Age limits of 20 through 44 years were established because younger persons were not listed in the directories, and because Boulder tap water may have contained fluorides from adjacent watersheds prior to establishment of the pipeline system in 1906. A white male was included in the sample if he was listed as a student in the school census record for 1920, 1930, or 1940 and as a resident in the current city directory, and if his birth record indicated that his mother's usual residence at the time of his birth was accessible to the city water system as it then existed. The same procedure was followed for white females, except that it was necessary to procure the married name from the county marriage records before the lists could be checked against the birth records or the directories.[2]

[2] Listing of females was incomplete in both city directories; about 30 percent of females in the samples were discovered through a check of the city telephone directories.

The Study Samples

When assembled, the sample lists were compared for race and occupation with 1940 census data. The samples proved to be random cross sections of all the people of the two communities. An attempt was made to examine each listed person, and it is believed that about five-sixths of the actual number of eligible persons was examined in each community.

All of the persons reported upon here were white native residents of one of the two cities. In each community about 90 percent of their parents had been born in the United States, about 3 percent in the British Empire, about 3 percent in one of the Scandinavian countries, and about 1 percent in Central Europe. More than half of the women were housewives and most of the rest were clerical and sales workers. Most of the men were professional or semiprofessional workers, business proprietors, skilled craftsmen, or students. There were comparatively few unskilled or semiskilled workers in either group. As estimated from 1940 census data, the past per capita incomes of the two groups seem to have been very nearly the same. College graduates made up a high percentage of each sample—about 40 percent at Boulder and about 20 percent at Colorado Springs. Both groups had received adequate dental care of high quality and personal dental hygiene was generally good.

Criteria and Method of Examination

Clinical dental examinations were conducted in Boulder in July and August 1950, and in Colorado Springs during September, October, and December of the same year. All examinations were made by the senior author, using mouth mirror and explorer. Most of the examinations were made by appointment at a central clinic [3] where a dental chair and operating light were available. Nonresponse was tested through house calls or calls at the place of employment; examinations away from the clinic were made under light from a Hood head lamp.

"Catches," or deep pits and fissures, were not considered carious in the absence of other indications of caries. The outline of each lesion or restoration was sketched on a morphological tooth chart by the examiner. The primary reason for extraction, based upon a history of signs and symptoms, was recorded for each missing tooth. The condition of the gingival tissues was assessed in detail. The criteria for fluorosis followed those established by Dean (*10*). Also recorded for each examinee were his name, age, sex, present address, usual occupation, number of school years completed, water and residence histories, and the salient facts of his health history. The examination and history taking required about 15 minutes per person.

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[3] In the Boulder Medical Center at Boulder and in Memorial Hospital, Colorado Springs.

The findings for each examinee were included in the tabulation if his residence and usage of the local water were unbroken except for periods not exceeding 60 days during the commonly accepted calcification and eruption periods of the permanent teeth, and if thereafter he had spent more than half of his life in residence with use of the water in question. The commonest history showed unbroken residence for 18 to 20 years, departure to enter school or the armed forces, and return when schooling or the period of service had been completed.

In tabulation a tooth with an unfilled carious lesion plus a restoration was counted as a filled tooth.

Findings

Fluorosis

All of the eligible persons examined at Boulder were free of fluorosis.

The distribution of fluorosis ratings by individuals at Colorado Springs is shown in table 2. The odds are about five to one that all variations from the common pattern are due to chance. This finding supports the deduction of Dean, Arnold, and Elvove that "the inhabitants of Colorado Springs . . . . have been using a relatively similar type of water for at least as long as 60 years" (*6*).

Table 2. *Individual fluorosis ratings of Colorado Springs natives, 1950*

Age group	Number of persons	Numbers with stated degree of fluorosis				
		Normal or questionable	Very mild	Mild	Moderate	Severe
20–24	72	15	29	20	7	1
25–29	101	18	41	35	6	1
30–34	82	15	41	16	8	2
35–39	75	10	34	24	6	1
40–44	55	5	29	14	5	2
Total	385	63	174	109	32	7

Decayed, Missing, or Filled Permanent Teeth

The age-sex composition of the study groups, with their rates for DMF (decayed, missing, or filled permanent) teeth are summarized in table 3 and pictured in figure 1. For purposes of comparison, DMF rates reported for insurance company employees in New York City by Hollander and Dunning (*11*) are also shown in figure 1. The Boulder rates lag the New York rates at the three younger age points.[4] Particularly at Boulder there was a tight grouping of individual

[4] Delayed onset of dental caries may be typical of this geographical area. Senn reported a DMF rate of 11.8 for Colorado aviation cadets against a rate of 19.4 for similar cadets from the State of New York (*12*). While his Colorado group probably included men from fluoride as well as nonfluoride areas, his rates for Montana and Wyoming are also low (10.5 and 13.1, respectively) and fluoride waters are less common in the two latter States. Schlack and Birren found an average of 11.7 dental defects per man in 3,672 naval recruits from Arizona, Colorado, Idaho, Montana, Nevada, Utah, and Wyoming, compared with 17.6 per man in 12,972 recruits from New Jersey, New York, and Pennsylvania (*13*).

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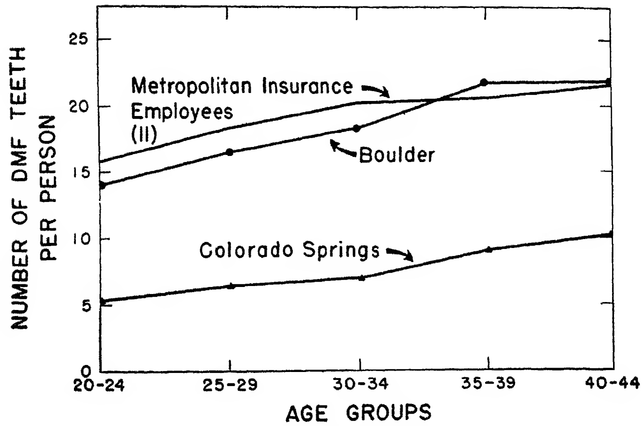

Figure 1. Total DMF rates, third molars excluded, in adult natives of Boulder and of Colorado Springs, Colo., compared with rates reported for Metropolitan Life Insurance Company employees.

findings around the average finding so that standard deviations are narrow in ratio to the rates, and the standard errors are small. Hence, these rates are more dependable than rates taken from typical samples of children many times larger would have been (*14*). They plot smoothly and follow the general shape of the Colorado Springs curve except at ages 40–44, where the standard error is wide and the actual finding may be somewhat low. The differences between the two communities are statistically valid at each age point and for the pattern as a whole.

In children the DMF rate is a measure of dental caries experience and little else. In adults it also includes an accumulation of teeth lost from periodontal disease or from trauma, or restored because of fracture, erosion, and the like. Those fractions of the present rates which were due primarily to causes other than dental caries are indicated in table 3. They are approximately equal in the two study groups—amounting, over-all, to about 1.0 tooth per person at Boulder and to about .8 tooth per person at Colorado Springs. Hence the disparity in the rates is due to a difference in dental caries experience in the two populations. The Colorado Springs rate is about 60 percent less than the Boulder rate at each age point. This is about the same magnitude of dental caries inhibition previously reported for children who were natives of a fluoride area (*15*).

Filled Tooth Surfaces

In each group about three-quarters of all DMF teeth were filled. There was a tendency toward pit-and-fissure fillings at Colorado Springs, and toward multisurface restorations at Boulder. This difference is conservatively expressed by the ratio of filled surfaces to

Table 3. *Total numbers of decayed, missing, and filled permanent teeth in adult natives of Boulder and Colorado Springs, Colo., excluding third molars*

Age group, years	Number of persons			Numbers of teeth				DMF rate	Standard deviation of the rate	Standard error of the rate	Segment of rate due to	
	Male	Female	Both	Decayed	Missing	Filled	Total DMF				Periodontal disease	Other causes
Boulder												
20-24	22	29	51	56	64	596	716	14.0	4.9	0.69		0.2
25-29	26	15	41	49	104	523	676	16.5	5.5	.86		.5
30-34	17	12	29	33	116	381	530	18.3	5.2	.97	1.9	.1
35-39	8	14	22	14	250	216	480	21.8	5.1	1.09	1.3	.1
40-44	6	6	12	11	145	104	260	21.7	6.0	1.73	2.3	.3
All ages	79	76	155	163	679	1,820	2,662	17.2			.7	3
Colorado Springs												
20-24	36	36	72	16	41	332	389	5.4	5.1	0.60		0.2
25-29	61	40	101	30	90	536	656	6.5	5.0	.50		.3
30-34	55	27	82	10	93	476	579	7.1	4.9	54		.3
35-39	51	24	75	13	240	435	688	9.2	7.0	.81	1.0	.6
40-44	36	19	55	7	170	388	565	10.3	6.4	.86	.6	1.0
All ages	239	146	385	76	634	2,167	2,877	7.5			.3	.5

filled teeth. At all ages the mean number of filled surfaces per filled tooth was slightly more than two at Boulder and slightly more than one and one-half at Colorado Springs. The ratios for all teeth, by age groups, are shown in figure 2.

Caries-Free Individuals

No person in the Boulder group was caries-free. Caries-free individuals made up the following percentages of persons examined at Colorado Springs:

Age group	*Colorado Springs, percent caries-free*
20–24	26.4
25–29	7.9
30–34	7.3
35–39	9.3
40–44	1.8

Tooth Mortality

Data concerning tooth mortality in the two communities are given in table 4. The rates are significantly different at each age point and for the pattern as a whole. Compared with Colorado Springs, Boulder natives had lost more than three times as many teeth from dental caries, appreciably but not significantly more from periodontal disease, and slightly and insignificantly fewer from other causes.

When tooth mortality rates are plotted against the number of school years completed per person (fig. 3), there is a considerable difference in favor of those persons who had completed one or more years of

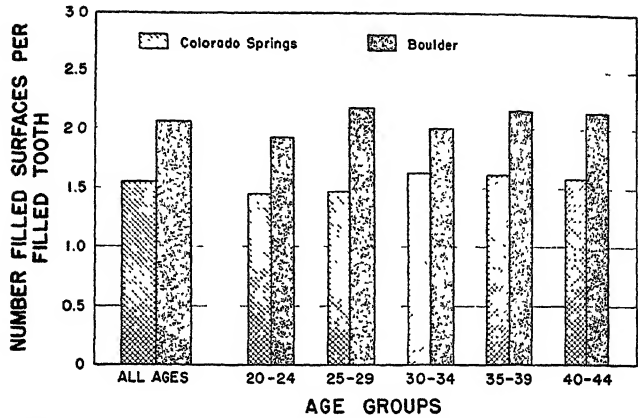

Figure 2. Mean numbers of filled tooth surfaces per filled tooth in adult natives of Boulder and of Colorado Springs, Colo.

college. This is not due to a preponderance of college people at the younger ages and of noncollege people at the older ages, a fact illustrated by the age-specific breakdown in figure 4.

Table 4. *Tooth mortality experience in adult natives of Boulder and of Colorado Springs, Colo., third molars excluded*

Age group, years	Number persons	Number missing teeth	Total tooth mortality rates			Teeth missing due to—					
			Mortality rate	Standard deviation	Standard error	Dental caries		Periodontal disease		Other	
						Number	Rate	Number	Rate	Number	Rate
Boulder											
20-24	51	64	1.26	2.10	0.29	53	1.04	--------	--------	11	0.22
25-29	41	104	2.54	3.71	.58	88	2.15	1	0.02	15	.37
30-34	29	116	4.00	7.16	1.33	59	2.03	56	1.93	1	.03
35-39	22	250	11.36	11.94	2.55	221	10.05	28	1.27	1	.05
40-44	12	145	12.08	11.37	3.28	116	9.67	27	2.25	2	.17
All ages	155	679	4.38	--------	--------	537	3.47	112	.72	30	.19
Colorado Springs											
20-24	72	41	0.57	1.50	0.18	28	0.39	2	0.03	11	0.15
25-29	101	90	.89	1.54	.15	74	.73	1	.01	15	.15
30-34	82	93	1.13	1.93	.21	75	.92	1	.01	17	.21
35-39	75	240	3.20	6.42	.74	122	1.63	77	1.03	41	.55
40-44	55	170	3.09	5.55	.75	100	1.82	32	.58	38	.69
All ages	385	634	1.65	--------	--------	399	1.04	113	.29	122	.32

Since two-thirds of the Boulder group were college people and two-thirds of the Colorado Springs group were noncollege people, it is clear that tooth mortality rates must be adjusted for this factor if direct comparisons between the two groups are to be considered valid.

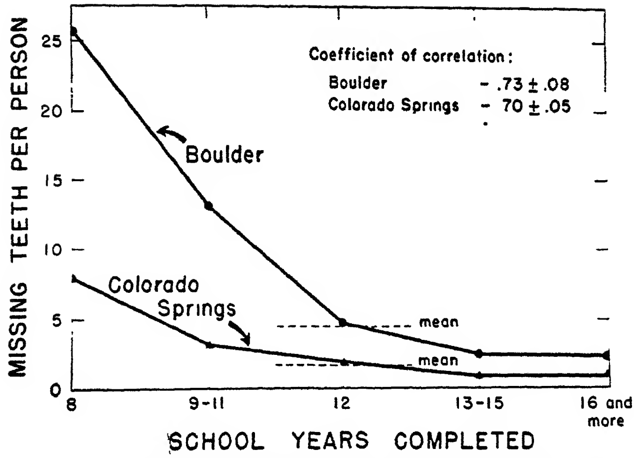

Figure 3. Tooth mortality rates in the two groups of Boulder and of Colorado Springs, Colo., natives, by number of school years completed.

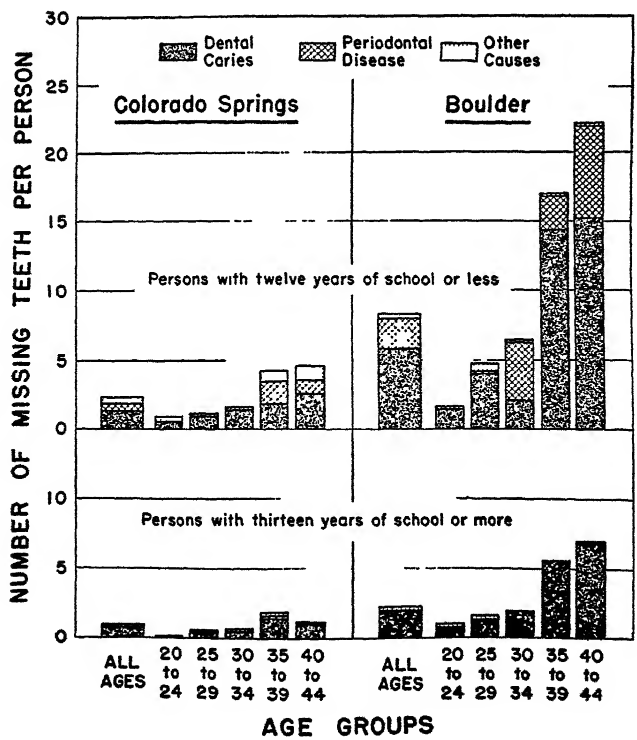

Figure 4. Tooth mortality rates in Boulder and in Colorado Springs, Colo., natives with 12 years of school or less and with 13 years of school or more, third molars omitted.

Tooth mortality rates so adjusted are listed in table 5 and portrayed in figure 5. The effect of this adjustment is to raise Boulder tooth mortality rates as compared with Colorado Springs. On this basis Boulder natives have lost about four times as many teeth from dental caries as have natives of Colorado Springs.

Third Molars

Third molars have been excluded in all of the data so far presented. In both populations the percentages of third molars in eruption which were decayed, missing, or filled was high, rising with age from 70 to nearly 100 percent at Boulder and from 50 to over 90 percent at Colorado Springs. About three-quarters of all DMF third molars were missing in both groups. At Boulder 94 percent of third molar loss was reported as due to dental caries and about three percent as due to malposition of the teeth. At Colorado Springs about 36 percent of third molar loss was reportedly due to dental caries and about 62 percent to malposition of the teeth.

Discussion

The most reliable measure of the difference in the dental caries experience of these two groups is the difference between their total DMF rates (table 3 and fig. 1). These rates were not disturbed by differences in sex, education, or economic status, and so far as they are concerned the two groups seem to be directly comparable in every respect except use of a fluoride-free water on the one hand and use of a fluoride-bearing water on the other. They support the findings

Table 5. *Tooth mortality rates in natives of Boulder and of Colorado Springs, Colo., adjusted for numbers of school years completed*

Age group	Total mortality rate	Fraction of rate due to		
		Caries	Periodontal disease	Other
Boulder				
20–24	1.38	1.19	----------	0.19
25–29	3.27	2.83	0.05	.39
30–34	4.25	2.04	2.17	.04
35–39	11.41	10.08	1.28	.05
40–44	14.68	11.09	3.40	.19
All ages	5.33	4.07	1.06	.19
Colorado Springs				
20–24	0.48	0.33	0.02	0 13
25–29	.84	.69	.01	.14
30–34	1.09	.86	.01	.22
35–39	3.10	1.61	.96	.52
40–44	2.94	1.76	.54	.65
All ages	1.55	.99	.27	.30

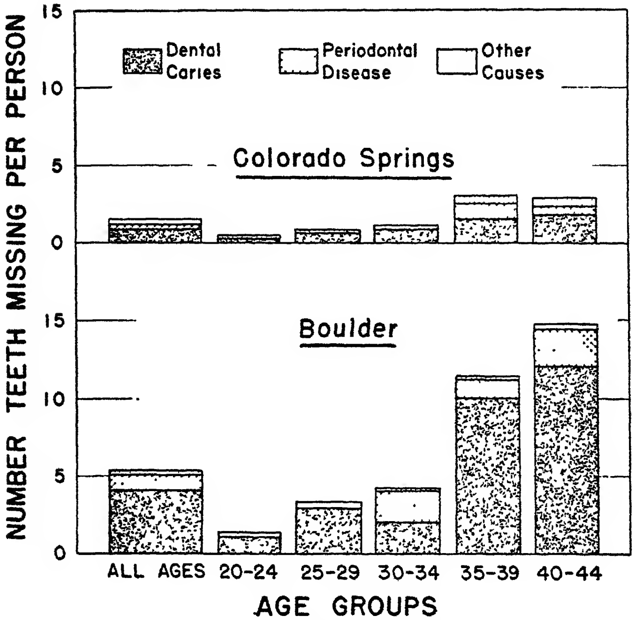

Figure 5. Tooth mortality rates in natives of Boulder and of Colorado Springs, Colo., adjusted for the common number of school years completed.

of Deatherage (*3*, *4*) in all respects and, although somewhat higher than those reported from a less representative group, are in accord with the principal conclusions of McKay (*5*).[5]

Direct comparisons with Weaver's data are not valid since he presents essentially tooth mortality rates; in his nonfluoride and fluoride groups 86.2 percent and 82.4 percent, respectively, of all DMF teeth were missing or indicated for extraction. His sample was highly selected—"mothers attending maternity and child welfare centers," of whom the great majority "had not well-cared-for mouths" (*2*). The present findings (fig. 4) indicate that tooth mortality may be affected by factors other than the severity of dental caries per se. For example, a considerable tooth loss from periodontal disease may occur in Colorado citizens with less than average schooling at the ages considered by Weaver in his study. None of the data for the Colorado groups suggest that Colorado Springs caries rates will "catch up" with those for Boulder natives inside a normal human life span.

Summary and Conclusions

1. Objective lists of natives 20–44 years old with verified histories of residence and water usage were prepared in Boulder, Colo., where

[5] Since this report was prepared for publication a personal communication describing a comparable study has been received from Peter Adler. Adler found that female natives of Kunszemarton, Hungary, where the water contains from 0 8 to 1.6 ppm of fluorides, showed lower dental caries rates through the age range of 21 to 45 years than did newcomers to Kunszemarton or comparable natives of Nagybaracska, Debrecen, and vicinity who had used waters which were low in fluoride.

the communal water is virtually fluoride-free, and in Colorado Springs, Colo., where the communal water contains about 2.5 ppm of fluorides. The cities are otherwise similar and the two groups are comparable in race and occupation. Persons on the lists were given dental examinations with mouth mirror and explorer.

2. The prevalence of fluorosis was uniform through the age range at Colorado Springs. No fluorosis was seen in natives of Boulder.

3. Total rates for decayed, missing, or filled permanent teeth were about 60 percent lower in Colorado Springs than in Boulder for each age group. The phenomenon of caries inhibition continued undiminished through the age of 44 years.

4. Boulder natives had lost three or four times as many teeth from dental caries as had natives of Colorado Springs.

5. The observed caries-inhibitory effect was essentially similar in pattern and in magnitude to that seen in children native to fluoride areas.

ACKNOWLEDGMENTS

Sincere thanks are due to Health Officers H. L. Morency of Boulder and M. F. Schafer of Colorado Springs; to Dr. Robert A. Downs, director, public health dentistry section, Colorado State Department of Health; to the Boulder Medical Center, the Daily Camera, radio station KBOL, Mr. and Mrs. N. H. Burbank, Dean A. Sanborn, Robert C. Looney, Mr. and Mrs. Quentin R. Krantz, Clyde C. Gelwick, Russell Shaffer, and Dr. G. M. Dean, Dr. Charles A. Monroe, Dr. W. D. McCabe, Dr. John D. Gillaspie, and Dr. L. E. Maurer, all of Boulder; to the Memorial Hospital, the Gazette-Telegraph, the Free Press, radio stations KRDO and KVOR, Mrs. Francis Demaree, Miss Dorothy Moomaw, Kenneth R. Card, Dan F. Santry, Jr., Carl Bennett, Howard J. Arnberg, Mrs. Mary E. Rymer, Mrs. Anna Goddard, J. S. Nichols, Malcolm Anderson, J. Zimoski, Mrs. Andrea DiSessa, and Dr. F. S. McKay and Dr. Kenneth Johnson, all of Colorado Springs; and, because this study could not have been attempted without their full and whole-hearted cooperation, to each person in the study groups.

REFERENCES

(1) Weaver, Robert: Fluorosis and dental caries on Tyneside. Brit. Dent. J. **76**: 28–40 (1944).
(2) Weaver, Robert: Fluorine and dental caries: Further investigations on Tyneside and in Sunderland. Brit. Dent. J. **77**: 185–93 (1944).
(3) Deatherage, C. F.: Fluoride domestic waters and dental caries experience in 2,026 white Illinois selective servicemen. J. Dent. Research **22**: 129–37 (1943).
(4) Deatherage, C. F.: A study of fluoride domestic waters and dental caries experience in 263 white Illinois selective servicemen living in fluoride areas following the period of calcification of the permanent teeth. J. Dent. Research **22**: 173–80 (1943).
(5) McKay, F. S.: Mass control of dental caries through the use of domestic water supplies containing fluorine. Am. J. Pub. Health **38**: 828–32 (1948).
(6) Dean, H. T., Arnold, F. A., Jr., and Elvove, Elias: Domestic water and dental caries. V. Additional studies of the relation of fluoride domestic waters to dental caries experience in 4,425 white children aged 12 to 14 years, of 13 cities in 4 States. Pub. Health Rep. **57**: 1155–79 (1942).
(7) Dean, H. T., and Elvove, Elias: Studies on the minimal threshold of the dental sign of chronic endemic fluorosis (mottled enamel). Pub. Health Rep. **50**: 1719–29 (1935).

(8) Wahlstrom, E. E.: Ore deposits at Camp Albion, Boulder County, Colorado. Econ. Geol. **35:** 477–500 (1940).
(9) Wahlstrom, E. E.: Personal communication, April 13, 1950.
(10) Dean, H. T.: The investigation of physiological effects by the epidemiological method. *In* Fluorine and Dental Health, edited by F. R. Moulton, Washington, American Association for the Advancement of Science, 1942, pp. 23–31.
(11) Hollander, Franklin, and Dunning, J. M.: A study by age, and sex of the incidence of dental caries in over 12,000 persons. J. Dent. Research **18:** 43–60 (1939).
(12) Senn, W. W.: Incidence of dental caries among aviation cadets. Mil. Surgeon **93:** 461–4 (1943).
(13) Schlack, C. A., and Birren, J. E.: Dental status of 71,015 Naval personnel examined in 1942. Number of dental defects per person with regional and age variations. Naval Medical Research Institute, Research Project x–131; Report No. 3, April 15, 1946.
(14) Dunning, J. M.: Variability in dental caries experience and its implication upon sample size. J. Dent. Research **29:** 541–8 (1950).
(15) Dean, H. T.: Epidemiological studies in the United States. *In* Dental Caries and Fluorine, edited by F. R. Moulton, Washington, American Association for the Advancement of Science, 1946, pp. 5–31.

The Viability *of Brucella melitensis* in Naturally Infected Cured Hams

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The fate of *Brucella* in the carcasses of naturally infected hogs subjected to packing plant processing is of considerable interest and importance. The lack of adequate data in this area is somewhat surprising. Huddleson et al. (*1*) studied the viability of *Brucella suis* in the spleens of naturally infected swine immersed in brine and held at a temperature of 40° F. Cultures were made periodically up to 45 days. They found a considerable reduction in the number of organisms recovered after 5 days in brine as compared to fresh specimens, but in some instances positive cultures were obtained after 40 days. The distribution of *Br. suis* in fresh hog carcasses and the viability under refrigeration were reported in previous studies (*2*). *Br. suis* was found to be widely disseminated throughout the carcass and to remain viable under refrigeration for as long as 21 days.

The present study was undertaken primarily to determine the effect of curing and smoking on the viability of *Brucella* in naturally infected hams. Limited data are also presented on the survival of *Brucella* in cured shoulders and on the distribution of *Brucella melitensis* in the fresh hog carcass.

Materials and Methods

Eleven yearling hogs weighing from 300 to 400 pounds were purchased in May 1949 from a herd in southern Indiana which was exhibiting marked clinical evidence of brucellosis. Numerous abortions prompted the owner to dispose of the herd. The purchased hogs all had positive *Brucella* agglutination tests as determined by the standard test tube method. All cultures obtained from these hogs were identified as *Br. melitensis* by the usual procedures. Identification of the *Brucella* species was accomplished by determination of CO_2 requirement, H_2S production, growth on differential dye plates, and by the use of specific absorbed typing sera.

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Note: Published as Journal Paper No. 532 of the Purdue University Agricultural Experiment Station, Lafayette, Ind.

Prior to slaughter, blood for culture was obtained from each animal. The hogs were slaughtered and processed in an improvised abbatoir closely simulating packing plant conditions. The animals were killed by sticking in the fashion usually employed commercially. Bleeding, scalding, dehairing, cutting of the carcass, chilling, and injection and curing of the hams and shoulders were all done by experienced specialized personnel from one of the Chicago packing plants. All operations were closely controlled according to the specifications used commercially.[1]

Immediately after slaughter, cultures for *Brucella* were made from the following areas of the carcass: mandibular, suprapharyngeal, cervical, prescapular, bronchial, gastrohepatic, mesenteric, superficial inguinal, internal iliac, prefemoral and uterine lymph nodes, liver, spleen, loin muscle, ovaries, uterus, and mammary glands.

Twenty-four hours after slaughter, immediately after pumping of the hams and before placing them in cover solution, cultures were made of the ham muscle, prefemoral and popliteal lymph nodes, and any other nodes which had not been removed in the trimming process. The specimens were divided into two equal groups, each group comprised of one ham from each hog. One group of specimens was studied at the Purdue University Department of Veterinary Science Laboratories; the other group was studied at the Brucellosis Laboratory of the University of Chicago and the National Institutes of Health. The cultural methods employed were those in routine use in the respective laboratories and have been described previously (*2–4*). The hams were held in cover solution in refrigerators at 32° to 36° F. for 20 or 21 days.

During the period that the hams were held in cover solution, cultures from lymph nodes and muscles were made at intervals as detailed in table 3. Parallel guinea pig inoculations were also done in most instances.

After 20 days some of the hams previously yielding positive cultures were subjected to "smoking." This process was carried out in the usual manner in a commercial packing plant.[2] The smoked hams were then returned to the respective laboratories and thoroughly examined. All available lymph nodes and samples of the ham muscle were cultured, and tissue suspensions were injected into guinea pigs. The main vascular trees were dissected and ground up for culture and animal inoculation.

The pickled shoulders were similarly divided into two groups, held

[1] The pumping solutions and cover pickle regularly used commercially were provided by a Chicago packing plant. The salt content of the solutions was as follows: ham pumping, 21.8 percent; ham cover pickle, 14.8 percent; shoulder pumping, 16.7 percent; shoulder cover pickle, 11.8 percent. Information on the other ingredients of the solutions is not available to us.

[2] The smoking operations specified a 21-hour period at 148°–150° F, which is sufficient to establish a minimum internal temperature of 137° F.

Table 1. Brucella *agglutination titers of 11 hogs naturally infected with* Brucella melitensis

Hog No.	Serum dilution				
	1/25	1/50	1/100	1/200	1/400
1	+	+	+	+	P
2	+	+	+	P	T
3	+	+	+	+	T
4	+	+	P	T	-
5	+	+	+	+	P
6	+	P	T	-	-
7	+	+	+	+	P
8	+	+	P	T	-
9	+	+	P	T	-
10	P	T	-	-	-
11	P	P	T	-	-

+=complete agglutination.
P=partial agglutination.
T=trace agglutination.

in cover solution at refrigeration, and cultured periodically. But the sparsity of available attached lymph nodes made this part of the study less satisfactory. None of the shoulders were subjected to the smoking process.

Results

The agglutination titers of the slaughtered hogs are presented in table 1. Tests were positive in some degree in all 11 hogs, but as would be expected, the variation was considerable. In 4 animals agglutination was complete at a dilution of 1/200, while for 2 other animals agglutination was only partial at the lowest dilution, 1/25. In 5, agglutination was complete at a dilution of 1/100, with complete or partial agglutination at one or more higher dilutions. Of the blood cultures made the day before slaughter, only one was positive, that of hog No. 2.

Data on the distribution of *Br. melitensis* in the carcasses of the 11 slaughtered hogs are presented in table 2. When possible, bacteriologic examinations were made of 27 areas, 19 lymph nodes, and 8 other tissues or organs, but in some animals all areas were not available for culture. *Brucella* organisms were recovered from widely scattered tissues throughout the body. *Brucella* was recovered in one or more animals from every area cultured with the exception of loin muscle. Of the 272 cultures of the fresh carcasses which were made, 100, or 36.8 percent, yielded *Brucella.*

Data are presented in table 3 on the survival of *Br. melitensis* in hams at varying periods after pumping and submersion in cover pickle. Only the 15 hams are included from which *Brucella* was recovered on one or more occasions. These represent specimens from 10 of the 11 hogs. Failure to recover *Brucella* from either ham occurred only with hog No. 6. However, 12 of the 26 fresh carcass cultures in this animal (table 2) yielded *Brucella.*

In 9 of the 15 hams, *Br. melitensis* was recovered from the ham muscle or from the lymph nodes normally present in market hams for as long as 14 to 21 days after pumping and submersion in cover pickle. In the initial culturing immediately after pumping but prior to submersion in the cover pickle, *Brucella* was recovered in only 9 of the 22 hams, but positive cultures were obtained in subsequent samplings from 6 additional hams. In 6 hams (3L, 5R, 7L, 7R, 10R, 11L) individual lymph nodes which had been negative to culture on the first two or three attempts eventually yielded the organism on subsequent reculturing. In the 15 hams, a total of 21 different areas yielded *Brucella*, positive cultures being obtained from two or three different areas in 5 hams.

In the 11 hams subjected to the smoking process after 20 days in cover pickle, *Brucella* was not recovered in any instance.

Table 2. *Distribution of* Brucella melitensis *in the tissues of 11 naturally infected hogs at the time of slaughter*

Tissue	Hog No.										
	1	2	3	4	5	6	7	8	9	10	11
Lymph nodes:											
Right prefemoral	−	+	−	−	−	+	+	+	−	+	−
Left prefemoral	−	+	−	−	−	+	+	−	+	+	−
Right superficial inguinal	+	+	−	−	−	+	+	−	+	−	−
Left superficial inguinal	−	+	−	−	−	+	+	−	+	−	−
Right internal iliac	−	−	+	−	−	+	−	+	+	+	−
Left internal iliac	+	+	−	−	−	+	−	+	+	−	−
Mesenteric	−	+	−	−	+	−	−	+	+	+	−
Bronchial	+	+	−	+	−	+	+	+	+	+	−
Gastrohepatic	+	+	−	+	+	−	+	+	+	+	−
Right mandibular	−	+	−	−	−	+	−	+	+	+	−
Left mandibular	+	+	−	+	+	+	−	+	+	+	+
Right suprapharyngeal	−	−	----	+	−	−	−	−	+	−	----
Left suprapharyngeal	−	−	----	+	−	----	+	−	−	−	----
Right prescapular	−	−	----	−	−	−	−	+	−	−	−
Left prescapular	−	+	----	−	−	−	−	−	−	−	−
Right uterine	----	+	----	----	−	−	----	−	----	----	----
Left uterine	----	+	----	----	−	−	----	−	----	----	----
Right cervical	----	+	−	----	−	+	+	−	−	−	+
Left cervical	+	+	−	----	−	−	−	−	−	−	−
Liver	−	−	+	−	+	+	−	−	+	−	−
Spleen	−	+	+	+	−	+	−	−	+	−	−
Loin muscle	−	−	−	−	−	−	−	−	−	−	−
Right ovary	−	+	−	−	+	−	−	−	−	−	−
Left ovary	−	+	−	−	+	−	−	−	−	−	−
Uterus, right horn	−	+	+	−	+	−	−	+	−	−	−
Uterus, left horn	−	+	+	−	−	−	−	+	−	−	−
Mammary glands	−	−	−	----	+	−	+	−	−	−	−

+ = *Brucella melitensis* recovered by culture.
− = *Brucella* not recovered.

Due to the lack of available lymph nodes, the studies on the cured shoulders were unsatisfactory and not comparable to those with the hams. *Brucella* was isolated in seven instances only. Of the cultures taken immediately after pumping and before the shoulders were placed in the cover pickle, those from five of the shoulders yielded *Br. melitensis*, the organism being recovered from cultures of muscle from all five and from attached lymph nodes of two of them. One of these

Table 3. *Survival of* Brucella melitensis *in hams from naturally infected hogs during the curing process*

Ham No.	Lymph node or tissue	Days in cover pickle: 0[1]	6	7	14	17	19	21	After smoking[2]
1L	Ham	−	------	−	−	------	−	------	−
	Iliac	+	------	------	------	------	------	------	------
	Prefemoral	------	------	------	−	------	------	------	−
	Popliteal	+	------	−	−	------	−	------	−
2L	Ham	−	------	−	−	------	−	------	−
	Iliac	------	------	−	−	------	------	------	------
	Prefemoral	−	------	−	−	------	−	------	−
	Popliteal	+	------	+	+	------	------	------	−
2R	Ham	+	+	------	−	−	------	------	−
	Prefemoral	+	−	------	−	−	------	------	−
	Popliteal	+	−	------	−	−	------	------	−
3L	Ham	−	------	−	−	------	------	−	------
	Inguinal	------	------	------	−	------	------	------	------
	Prefemoral	−	------	−	−	------	------	−	------
	Popliteal	−	------	−	+	------	------	−	------
4R	Ham	−	+	------	−	−	------	------	−
	Popliteal	−	−	------	−	−	------	------	−
5R	Ham	−	−	------	+	−	------	------	−
	Prefemoral	−	−	------	−	------	−	------	−
	Popliteal	−	−	------	------	------	−	------	−
7L	Ham	−	------	−	−	------	------	−	------
	Inguinal	−	------	−	−	------	------	−	------
	Prefemoral	−	------	−	−	------	------	−	------
	Popliteal	−	------	−	−	------	------	+	------
7R	Ham	−	−	------	−	+	------	------	−
	Prefemoral	−	−	------	------	------	------	------	−
	Popliteal	+	−	------	−	−	------	------	−
8L	Ham	−	------	−	−	------	−	------	−
	Inguinal	+	------	−	−	------	−	------	−
	Prefemoral	−	------	−	−	------	------	------	------
	Popliteal	+	------	+	+	------	------	------	−
8R	Ham	−	−	------	−	−	------	------	------
	Prefemoral	------	−	------	−	−	------	------	------
	Popliteal	+	−	------	−	−			
9L	Ham	−	------	−	−	------	−	------	−
	Prefemoral	+	------	+	−	------	+	------	−
	Popliteal	------	------	------	−	------	------	------	−
9R	Ham	−	−	------	−	−	------	------	−
	Popliteal	+	−	------	−	−	------	------	−
10R	Ham	−	−	------	−	+	------	------	−
	Prefemoral	------	−	------	−	------	------	------	------
	Popliteal	------	------	------	−	------	------	------	−
11L	Ham	−	------	−	−	------	------	−	------
	Popliteal	−	------	−	−	------	------	+	------
11R	Ham	+	−	------	−	−	------	------	−
	Iliac	------	+	------	−	−	------	------	−
	Prefemoral	−	−	------	------	−	------	------	−
	Popliteal	−	−	------	−	−	------	------	−

[1] Examinations done immediately after arterial injection and prior to immersion in cover pickle.
[2] Examinations after smoking, in addition to those noted, included culture and guinea pig inoculation of ground suspensions of the main vascular tree as well as of ham muscle.

gave a positive culture from muscle after 7 days in cover pickle. *Br. melitensis* was recovered from a muscle culture of an additional shoulder, which had not yielded a culture initially, after 2 weeks in cover pickle.

Discussion

A study of this nature presents numerous difficulties. It seemed mandatory to simulate the commercial processes as closely as possible in order to make the results applicable under practical conditions. This was accomplished by obtaining the services of trained personnel for all routine and specialized procedures, by employing a portable refrigerated unit for chilling the carcasses, and using commercially prepared solutions for the curing processes. All steps were done in strict accordance with the packing plant specifications. Finally, the smoking of the hams was carried out in the commercial plant. Thus, these results may be regarded as representing those which might be obtained by culture of material from infected carcasses actually handled in a commercial plant.

The difficulties encountered in isolating *Brucella* from mixed culture are well known. Even with the precautions taken in this study in making cultures, the growth of extraneous organisms was not eliminated and, in the latter part of the study, possibly was a factor in the failure to recover *Brucella* more consistently.

Since the infected lymph nodes comprised the best tissue for consistent isolation, the need of conserving portions of nodes for the later examinations is readily apparent. Accordingly, all available lymph nodes were not always cultured at every examination period. Mechanical factors during the preparation of the hams for smoking eliminated some of the attached lymph nodes so that they were not available for later study.

Even in culturing a known infected lymph node, one may not always recover the organism. Reference to table 3 reveals a number of such instances. This probably represents an unequal distribution of organisms through the node and failure to section an infected area in the sampling.

It is apparent from the data presented that *Br. melitensis* remained viable during curing in cover pickle for as long as 21 days. The organism was not recovered after the smoking process. Although the number of hams in this experiment consistently yielding positive cultures prior to smoking is small, the hams were subjected to such thorough examination afterward that the failure to recover *Brucella* after smoking is probably a significant finding. These data should not be interpreted to mean that all commercial smoking processes make *Brucella* nonviable, or that home-smoked meats are necessarily safe.

The significance of *Br. melitensis* infection in swine is becoming increasingly apparent. The proved presence of *Br. melitensis* in hogs in this country is established (*3–7*). In the culture of mandibular lymph nodes of 5,000 slaughtered hogs, *Brucella* was isolated in 35

instances. Eleven, or 31.4 percent, of the isolations were *Br. melitensis* (*4*).

The hogs used in this study were obtained from a herd exhibiting the usual manifestations of epidemic clinical brucellosis in swine. That *Br. melitensis* can be responsible for such herd infection is of considerable practical importance. Cultural studies should be made in other centers to determine more fully the extent of this problem in swine.

Summary

Eleven yearling hogs naturally infected with *Br. melitensis* were slaughtered. Cultures made from many areas of the carcass demonstrated the organism to be widely distributed. The hams and shoulders were subjected to standard curing processes, 11 hams subsequently being smoked. Commercial procedures were followed throughout the experiment. *Brucella* was recovered from the hams for as long as 21 days in cover pickle. No isolations were made after smoking. The significance of *Br. melitensis* infection in swine is discussed.

REFERENCES

(*1*) Huddleson, I. F., Johnson, H. W., and Hamann, E. E.: A study of *Brucella* infection in swine and employees of packing-houses. J. Am. Vet. Med. Assoc. **83**: 16 (1932).

(*2*) Hutchings, L. M., Bunnell, D. E., Donham, C. R., and Bay, W. W.: The viability of *Brucella suis* in swine carcasses. (In press.)

(*3*) McCullough, N. B., Eisele, C. W., and Pavelchek, E.: Isolation of *Brucella abortus* from hogs. Pub. Health Rep. **64**: 537–538 (1949).

(*4*) McCullough, N. B., Eisele, C. W., and Pavelchek, E.: Survey of brucellosis in slaughtered hogs. Pub. Health Rep. **66**: 205–208 (1951).

(*5*) Huddleson, I. F.: Brucellosis in Man and Animals. New York, The Commonwealth Fund, 1943.

(*6*) Borts, I. H., McNutt, S. H., and Jordan, C. F.: *Brucella melitensis* isolated from swine tissues in Iowa. J.A.M.A. **130**: 966 (1946).

(*7*) Damon, S. R., and Scruggs, J. H.: Recovery of *Brucella melitensis* from the hog. Pub. Health Rep. **65**: 374 (1950).

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended October 6, 1951

Malaria

The numbers of cases of malaria both among civilians and from military establishments did not change significantly from the numbers reported during the previous 5 weeks. There were 14 cases reported in Georgia with the notation that all contracted their infection outside the United States. The 20 cases reported in Wisconsin were said not to have been contracted in the State. Two of the four civilian cases in California were reported to be in Mexican nationals with onsets 5 to 10 days after arrival in California. One case followed a vacation trip to Mexico with onset 2 days after return; the other case was a relapse in a person presumably infected in China.

Poliomyelitis

The incidence of poliomyelitis continued to decline during the current week, 1,272 cases being reported as compared with 1,405 cases for the week ended September 29, and 1,746 for the week ended September 22. For the same weeks last year there were 1,813, 1,990, and 2,169 cases, respectively.

The cumulative total cases of poliomyelitis for the calendar year is now 21,775 as compared with 23,341 for the same period last year. The cumulative total since the seasonal low week in March is 20,563 as compared with 22,210 last year. As the peak of incidence was reached earlier this year than last, and considering the marked reduction in number of cases in the last 2 weeks, present indications are that the total number for the year will be well below the 33,209 reported in 1950.

Epidemiological Reports

Gastroenteritis

Dr. Dean Fisher, Maine health officer, has reported an outbreak of gastroenteritis among a group of State employees following a supper consisting of chicken pie, vegetables, salad, and strawberry shortcake. An investigation by Dr. C. F. Thomas disclosed the fact that 80 persons became ill out of a total of 90 to 100 who were present about 5 hours after the meal. Some of the persons who prepared or served

the meal were also ill. No specimens of food were available for laboratory examination.

Dr. C. P. Stevick, North Carolina State Board of Health, has reported an outbreak of gastroenteritis which occurred among 600 persons attending a convention. Two to three hours after eating barbecue, 200 persons became ill. An investigation by Dr. William Happer showed that all items served, except the barbecue, were prepared in private homes in small quantities and were served in separate containers. The barbecue was prepared the day before and was not refrigerated the night before it was served. No specimens of food were available for bacteriological examination.

Dr. D. S. Fleming, Minnesota Department of Health, has reported an outbreak of food poisoning which followed a church supper attended by 230 to 240 persons. Four to five hours after eating chicken loaf sandwiches, approximately 110 persons became ill with severe abdominal cramps, profuse vomiting, and diarrhea. The chicken loaf was prepared on the day before serving. Eleven chickens were cooked, one at a time, in a pressure cooker. The meat was separated, ground, and placed in jars where it stood unrefrigerated overnight. The predominant organism found in leftover specimen of the loaf was a nonhemolytic streptococcus, but *Escherichia freundii* and *Aerobacter aerogenes* were also present.

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Oct. 6, 1951	Oct. 7, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	------	------	------	(1)	(1)	(1)	(1)	47	33	41
Diphtheria (055)	131	155	285	27th	844	1,176	2,077	2,852	4,304	6,687
Encephalitis, acute infectious (082)	21	29	18	(1)	(1)	(1)	(1)	817	736	506
Influenza (480–483)	403	660	525	30th	3,112	4,062	3,989	119,167	142,826	131,792
Measles (085)	1,192	683	683	35th	[2] 4,621	2,908	2,908	[2] 473,532	291,079	555,310
Meningitis, meningococcal (057.0)	45	44	46	37th	151	157	157	3,212	2,956	2,776
Pneumonia (490–493)	605	1,029	(3)	(1)	(1)	(1)	(1)	49,300	65,885	(3)
Poliomyelitis, acute (080)	1,272	1,813	1,207	11th	[4] 20,565	22,210	20,031	[4] 21,775	23,341	20,381
Rocky Mountain spotted fever (104)	5	9	6	(1)	(1)	(1)	(1)	302	431	516
Scarlet fever (050)[5]	525	586	722	32d	2,710	2,917	3,797	56,096	43,087	60,754
Smallpox (084)	------	1	1	35th	-------	1	3	11	27	51
Tularemia (059)	12	5	11	(1)	(1)	(1)	(1)	524	739	776
Typhoid and paratyphoid fever (040, 041)[6]	85	88	88	11th	2,007	2,256	2,580	2,442	2,766	3,065
Whooping cough (056)	829	1,577	1,577	39th	829	1,577	1,577	54,604	98,772	77,464

[1] Not computed. [2] Addition: West Virginia, week ended Sept. 29, 6 cases. [3] Data not available. [4] Deduction: Iowa, 2 cases—not allocated. [5] Including cases reported as streptococcal sore throat. [6] Including cases reported as salmonellosis.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Oct. 6, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	131	21	463	1,192	45	605	1,272
New England			1	138	4	24	44
Maine				28		2	4
New Hampshire				3		2	1
Vermont				30			
Massachusetts				56	3		14
Rhode Island				13			2
Connecticut			1	8	1	20	23
Middle Atlantic	7	2		319	3	64	141
New York	6	2	(1)	199	2		72
New Jersey				43		24	20
Pennsylvania	1			77	1	40	49
East North Central	6	4	9	272	4	46	343
Ohio				76	2		69
Indiana	3	2	8	11		5	17
Illinois	2	2	1	61	2	33	87
Michigan	1			73		8	68
Wisconsin				51			102
West North Central	4	1	10	43	6	83	176
Minnesota			3	4	3	3	34
Iowa	1			4	2		17
Missouri							51
North Dakota		1	6	22		69	6
South Dakota				5			8
Nebraska				5	1		21
Kansas	3		1	3		11	39
South Atlantic	61	2	244	68	12	110	71
Delaware							
Maryland	1			30	2	14	5
District of Columbia				2		12	3
Virginia	9		217	14	2	41	13
West Virginia	2			4	2		16
North Carolina	30			3	1		11
South Carolina	7		4	1		3	3
Georgia	6	2	23	13	5	40	16
Florida	6			1			4
East South Central	32		2	38	5	34	93
Kentucky	5			22	2	6	17
Tennessee	6			1	1		31
Alabama	20			9	1	21	16
Mississippi	1		2	6	1	7	29
West South Central	17	4	71	64	2	171	107
Arkansas	2		51	30		11	9
Louisiana	3		2	2		9	27
Oklahoma	6		18			12	16
Texas	6	4		32	2	139	55
Mountain	1	1	92	120	4	29	114
Montana			15	83	1	1	7
Idaho				9			1
Wyoming					1		13
Colorado			6	5		17	44
New Mexico			1	2	1	1	5
Arizona		1	70	9		10	8
Utah	1			12	1		34
Nevada							2
Pacific	3	7	34	130	5	44	183
Washington	1		17	24	1		18
Oregon		1	16	14		17	20
California	2	6	1	92	4	27	145
Alaska							4
Hawaii				103			2

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Oct. 6, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	5	525		12	85	831	116
New England		26			6	71	
Maine		2				2	
New Hampshire						1	
Vermont						2	
Massachusetts		19			3	53	
Rhode Island		4			2		
Connecticut		1			1	13	
Middle Atlantic		76			5	161	23
New York		38			3	67	21
New Jersey		9				34	
Pennsylvania		29			2	60	2
East North Central		141			8	148	12
Ohio		40			5	30	1
Indiana		9			1	7	7
Illinois		27			2	43	4
Michigan		47				68	
Wisconsin		18					
West North Central	1	23		1	6	39	15
Minnesota		2			1	10	6
Iowa	1	5			1	2	6
Missouri		7		1	4	13	3
North Dakota		1				3	
South Dakota						2	
Nebraska		2				1	
Kansas		6				8	
South Atlantic	4	78			8	91	9
Delaware		1					
Maryland		13				7	
District of Columbia		5				8	
Virginia	1	10				16	3
West Virginia		6			2	17	3
North Carolina	2	30			1	18	
South Carolina		4			1		2
Georgia	1	8			2	21	1
Florida		1			2	4	
East South Central		48		1	9	43	23
Kentucky		13			3	10	6
Tennessee		29			3	19	1
Alabama		5		1		9	10
Mississippi		1			3	5	6
West South Central		17		6	10	189	34
Arkansas		5		2		9	1
Louisiana		2				2	
Oklahoma		5				5	2
Texas		5		4	10	173	31
Mountain		15		4	6	32	
Montana		6		1		3	
Idaho		3				2	
Wyoming							
Colorado		2			3	11	
New Mexico		1			2		
Arizona					1	12	
Utah		3		3		4	
Nevada							
Pacific		101			27	57	
Washington		9			3	7	
Oregon		6				2	
California		86			24	48	
Alaska							
Hawaii						1	

[1] Including cases reported as streptococcal sore throat. [2] Including cases reported as salmonellosis.
Rabies in man. North Carolina, 1 case.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Sept. 22, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	6					3	1	2			
Chickenpox	259	1		15		35	97	27	20	50	14
Diphtheria	16				1	15					
Dysentery, bacillary	13					3	2				8
Encephalitis, infectious	5			4					1		
German measles	83			23		12	13		5	23	7
Influenza	23			21				1	1		
Measles	240	10		25	1	24	41	19	12	67	41
Meningitis, meningococcal	5	1					2		1		1
Mumps	193					23	78	15	33	20	24
Poliomyelitis	161			21	1	26	96	3	5	4	5
Scarlet fever	122	1		1	2	12	20	11	17	16	42
Tuberculosis (all forms)	219	1			11	69	30	33	22	25	28
Typhoid and paratyphoid fever	10					9				1	
Venereal diseases:											
Gonorrhea	331	4		11	6	75	73	42	21	40	59
Syphilis	108	1		5	5	45	16	15	3	10	8
Primary	6					3	2	1			
Secondary	8					3	2	1		2	
Other	94	1		5	5	39	12	13	3	8	8
Whooping cough	137			4		30	46	7	23	18	9

FINLAND

Reported Cases of Certain Diseases—August 1951

Diseases	Cases	Diseases	Cases
Diphtheria	32	Typhoid fever	5
Dysentery	2	Venereal diseases:	
Meningitis, meningococcal	3	Gonorrhea	654
Paratyphoid fever	119	Syphilis	20
Poliomyelitis	18	Other forms	1
Scarlet fever	737		

NEW ZEALAND

Reported Cases of Certain Diseases and Deaths—4 Weeks Ended Aug. 25, 1951

Disease	Cases	Deaths	Disease	Cases	Deaths
Brucellosis	6		Influenza	1	1
Diphtheria	9	1	Meningitis, meningococcal	23	4
Dysentery:			Poliomyelitis	2	
Amebic	7		Scarlet fever	67	
Bacillary	4		Tetanus	2	1
Erysipelas	13		Tuberculosis (all forms)	160	38
Food poisoning	214		Typhoid fever	9	

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Smallpox

Nigeria. During the week ended August 25, 1951, the incidence of smallpox in the seaport of Calabar rose to 11 cases from 1 reported for the previous week. The incidence, however, for the whole country showed little change during this period, 124 and 120 cases, respectively.

Togo (French). For the period September 11–20, 21 cases of smallpox were reported in the region of Tsevie.

Typhus Fever

Germany. During the week ended September 8, 1951, one case of typhus fever was reported in the seaport of Bremen.

India. For the week ended September 22, one case each of typhus fever was reported in Ahmedabad and Bombay.

Indochina. One case of typhus fever was reported in Cambodia for the week ended September 15.

Spain. For the week ended August 18, four cases of typhus fever were reported in Madrid as compared with one for the previous week.

Yugoslavia. Four cases of typhus fever were reported in Serbia during the period August 1–7.

Yellow Fever

Gold Coast. Yellow fever was reported in the Gold Coast as follows: September 19, one fatal suspected case in Accra; September 18, one suspected case in the Oda area; and September 5, one case at Akwatia.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price per year—$4.75, domestic; $6.25, foreign.

Public Health Reports

VOLUME 66 NOVEMBER 2, 1951 NUMBER 44

TUBERCULOSIS CONTROL ISSUE NO. 69

IN THIS ISSUE

FEDERAL SECURITY AGENCY

PUBLIC HEALTH SERVICE

FEDERAL SECURITY AGENCY
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PUBLIC HEALTH SERVICE
Leonard A. Scheele, Surgeon General

Division of Public Health Methods
G. St. J. Perrott, Chief of Division

CONTENTS

This is the sixty-ninth of a series of special issues of PUBLIC HEALTH REPORTS devoted exclusively to tuberculosis control. The special issues began March 1, 1946, and appear the first week of each month. The articles are reprinted as extracts. Effective with the July 5, 1946, issue, these extracts may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents a single copy. Subscriptions are obtainable at $1.00 per year, $1.25 foreign.

Public Health Reports

Vol. 66 • NOVEMBER 2, 1951 • *No. 44*

Field Studies on Immunization Against Tuberculosis

I. Tuberculin Allergy Following BCG Vaccination of School Children in Muscogee County, Georgia

By LAWRENCE W. SHAW, A.M.*

Early in 1947, the Tuberculosis Control Division of the Public Health Service initiated a series of cooperative studies directed toward an evaluation of the usefulness of BCG vaccination. The site of the first study was Muscogee County, Ga., a county containing Columbus, a city of 75,000, and a surrounding rural area of about 20,000 population. A broad facility for epidemiological research in tuberculosis had already been established in Muscogee County, previously described by Comstock (*1*). The first phase of the BCG inquiry was a control study among school-age children. This report is concerned with the extent of the tuberculin allergy detected in that population 6 months and 3 years after vaccination.

The vaccination program was conducted during April and May 1947. The base population was the entire enrollment of the public and private elementary and high schools of the county—about 16,000 children, mostly between the ages of 6 and 17 years. Parental consent for participation in the program was obtained for slightly more than 80 percent of the children. A first intradermal test of 0.0001 mg. of PPD (5 tuberculin units) was given to these children. Those having reactions with a diameter of 5 mm. or more of palpable induration were eliminated from further testing and the remainder were given the second test of 0.002 mg. PPD (100 tuberculin units). Children not showing reactions of 5 mm. or more of induration to the second test were regarded as eligible for vaccination.

Although detailed characteristics of the tuberculin sensitivity of the total school population in 1947 are to be published separately, certain summary results shown in table 1 bear directly on the findings to be presented in this paper. The frequency of responses to the 5 TU (8 percent in whites and 26 percent in Negroes) was not inconsistent with the general conception of the tuberculosis problem in the

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community, but the 100 TU test produced responses in an unexpectedly large segment (approximately 37 percent in each race). Since 1947, other evidence suggests that many reactions to the larger doses of tuberculin may be "nonspecific" and that Muscogee County lies in an area in which the frequency of these "nonspecific" responses may be especially high (*2*).

It seemed almost incredible that among young children in Muscogee County a level of tuberculous infection could exist as high as that indicated by the combined percentages of the two doses of tuberculin. However, only one course of action appeared appropriate on the basis of procedures then in use in BCG vaccination work: in addition to reactors to the 5 TU test, the large group reacting to the 100 TU test was considered ineligible for vaccination. Thus, only 56 percent of the white and 37 percent of Negro children were eligible for vaccination. These 4,839 children—3,766 white and 1,073 Negro—were principally in the lower school grades, 73 percent were under 12 years of age, and the average age was 9.6 years. This study group was divided by a type of alternation free of individual bias in such a way as to ensure two comparable groups, consisting of 2,498 vaccinated and 2,341 nonvaccinated controls.

Table 1. *Prevaccination tuberculin sensitivity of Muscogee County school children, to 5 and 100 tuberculin units,*[1] *spring 1947, by race*

Race	Total tested		Reactors [2] to—		Nonreactors to 100 TU	Total reactors to 5 and 100 TU
			5 TU	100 TU		
	Number	Percent	Percentages			
White	7,767	100.0	7.6	36.4	56.0	44.0
Negro	3,495	100.0	25.8	37.6	36.6	63.4

[1] 5 tuberculin units (TU)=0.0001 mg. PPD; 100 tuberculin units (TU)=0.002 mg. PPD.
[2] 5 mm. or more of induration.

About 6 months after vaccination, 70 percent of the vaccinated children were retested with tuberculin through visits to all schools except those in remote rural locations. The nonreactors to 100 TU were revaccinated (8 percent). Because of the short time interval since the prevaccination testing, it was assumed that allergy in the vaccinated group represented only the effect of BCG and that similar tests in the control group were unnecessary.

Early in 1950 the tuberculosis control program in Muscogee County was extended through a mass survey which offered an X-ray film of the chest, a tuberculin test, and vaccination with BCG to the population of the community, including neighboring Russell County, Ala. The tuberculin testing in 1950 was conducted without reference to the results of the 1947 school vaccination program: the nurses read-

ing the test were unaware of which children had participated in the earlier study. Thus, prevaccination tuberculin testing for the 1950 program furnished, as an objective byproduct, observations on the tuberculin sensitivity of the children included in the 1947 study group. Later matching of the records from the two programs provided the data for the present paper on the allergy of those vaccinated and those designated as controls in 1947.

In this connection, it may be mentioned that use of the same type of alternation as in 1947 for selecting vaccinated and controls among the nonreactors excluded the 1947 control group from vaccination in the 1950 program. Members of the 1947 vaccinated group who did not react to 5 TU in 1950 were revaccinated.

Table 2. *Extent of retesting of vaccinated and control groups 6 months and 3 years after vaccination (Muscogee County school children 1947 and 1950)*

Race	Number in BCG study		Extent of retesting							
			Vaccinated group						Control group	
	Vaccinated group	Control group	At 6 months		At 3 years		Both times		At 3 years	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent
White	1,948	1,818	1,327	68.1	1,138	58.4	842	43.2	1,102	60.6
Negro	550	523	391	71.1	308	56.0	236	42.9	277	53.0

Approximately 70 percent of the 1947 study group was reached in the 1950 tuberculosis survey. However, failure to receive a tuberculin test or to report for reading of the test, or conflicting data between the 1947 and 1950 records reduced to 57 percent the group on which data are available for this analysis. Table 2 shows by race the proportions of the vaccinated and control groups on which tuberculin data are available at 6 months and 3 years.

Materials and Methods

Tuberculin Testing

In the 1947 prevaccination tests and in the 6 months postvaccination tests, 0.0001 mg. PPD (5 TU) followed by 0.002 mg. PPD (100 TU) was employed, and the reactions were read at 48 hours. Measurement in millimeters of the transverse diameter of erythema and of the palpable induration, and a description of the density of the induration were recorded. The PPD, identified as lot number RT XVIII, was obtained from the Danish State Serum Institute through Dr. Johannes Holm.

Three years after vaccination, only the 5 TU test was used and the European practice of reading at 72 hours was employed. The

reading procedure was the same except that erythema was measured and recorded only in the absence of induration and more careful attention was given to the recording of cases of very small induration. The stock material was Danish PPD, lot RT XIX-XX-XXI, the successor to RT XVIII in the International Tuberculosis Campaign.

Vaccination

BCG vaccine for the program was obtained from Dr. S. R. Rosenthal of the Tice Laboratory, Chicago. Rosenthal's multiple puncture method, 3 rows of 10 punctures each, was applied on the deltoid surface of the left arm. Dr. Rosenthal personally instructed the field teams in methods of handling the vaccine and in using the multiple puncture technique. Five lots of vaccine were used—designated 811K, 811L, 812E, 812L, and 813E by the Tice Laboratory—each stated to contain 15 mg. of BCG organisms per milliliter. Refrigerated air shipments were made weekly to Columbus, and the vaccine was kept cold until opened for use in the schools on the third and fourth days after preparation.

Personnel

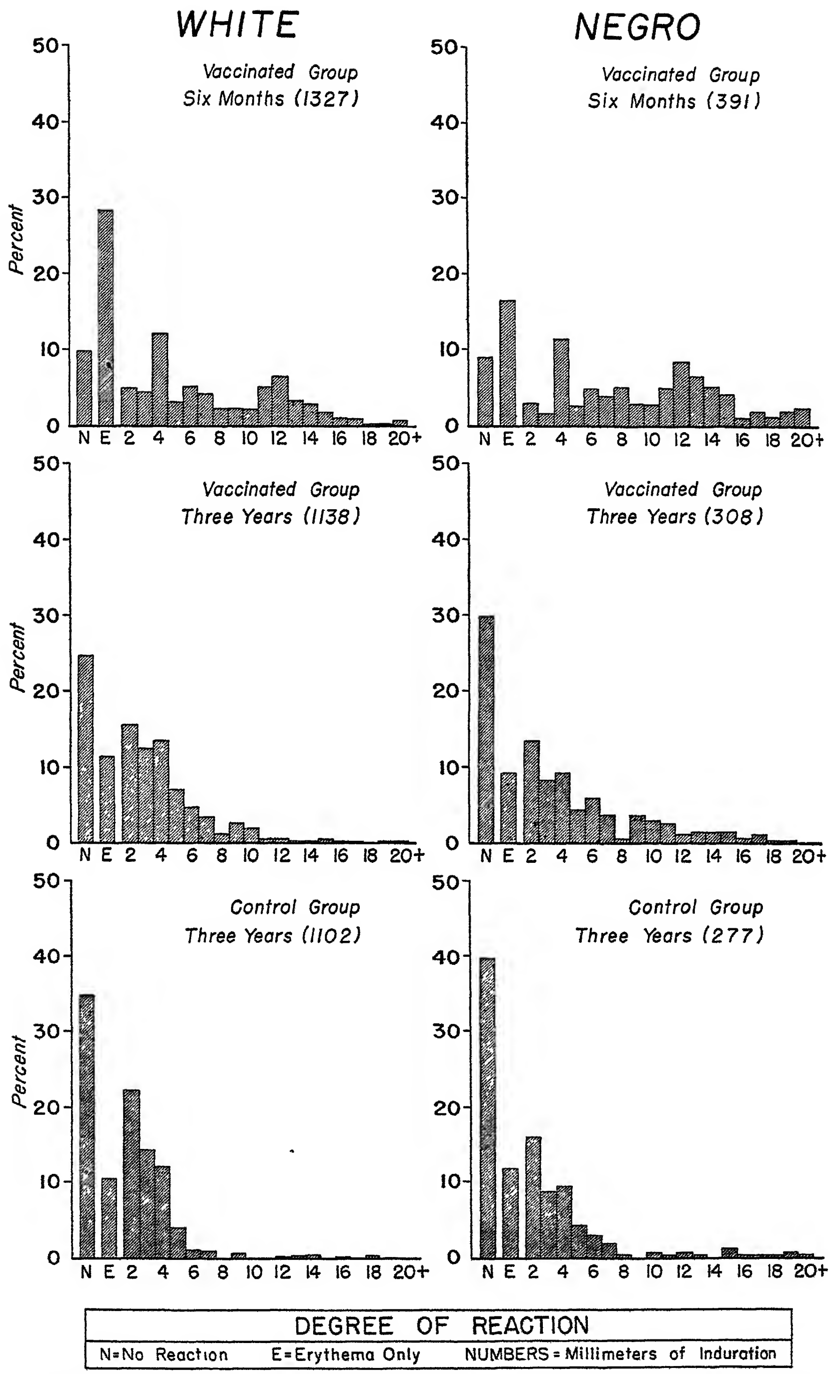
The initial testing and vaccination procedures in 1947 were performed by three Public Health Service teams of a doctor and a nurse. Most of the vaccinations were done by the doctors. Postvaccination observations were performed by Public Health Service nurses especially trained and experienced in tuberculin testing. It is believed that a considerable degree of uniformity was achieved in carrying out the field operations.

Results

Post vaccination allergy is usually reported simply in terms of the frequency of tuberculin conversions, that is, the percent reacting to the same tuberculin test or tests used to select persons for vaccination. Such summarization is clearly inadequate, as recent reports from the international counterpart of this office, the Tuberculosis Research Office of the World Health Organization have shown (*3*). Figure 1 and appendix table 1, therefore, present in detail the Muscogee County data, showing the reactions to the 5 TU test in the vaccinated group at 6 months and 3 years, and in the control group at 3 years. In addition, the extent of low grade allergy to this test possessed by each group before vaccination is given in the appendix table.

Tuberculin Allergy in the Vaccinated

As shown in the chart, the sizes of the 5 TU postvaccination reactions at 6 months are spread rather broadly over the scale from no reaction at all to those measuring 20 mm. or more of induration. At 3 years the reactions tended to be much smaller, with very few as



Distributions of the vaccinated and control groups by degree of reaction to 5 tuberculin units for tests at 6 months and at 3 years (appendix table 1).

large as 10 mm. and many measuring only 2 to 4 mm. in diameter. These numerous small indurated reactions at the 3-year observation may reflect the special care taken then to note and record them, and a considerable proportion of the "erythema only" observations in the 6-month data may represent small indurations not noted at that time. As summarized in table 3, it is clear that the degree of tuberculin sensitivity of the vaccinated apparently never reached a high level and that it declined very markedly.

Table 3. *Sensitivity to 5 tuberculin units (0.0001 mg. PPD) among vaccinated persons and nonvaccinated control persons at specified periods, by race (Muscogee County school children, 1947 and 1950)*

Degree of reaction	White					Negro				
	Vaccinated group			Control group		Vaccinated group			Control group	
	Tuberculin tested at					Tuberculin tested at				
	Origin	6 months	3 years	Origin	3 years	Origin	6 months	3 years	Origin	3 years
Percentage										
No reaction	83.7	9.7	24.5	83.8	34.3	85.5	9.0	29.9	81.7	39.7
Erythema only or induration less than 5 mm.	16.3	49.4	52.9	16.2	58.6	14.5	32.0	39.6	18.3	45.5
Induration 5-9 mm.	--------	16.8	18.9	--------	6.3	--------	19.2	17.9	--------	9.4
Induration 10 mm. or more	--------	24.0	3.7	--------	.8	--------	39.9	12.7	--------	5.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Induration 5 mm. or more	--------	40.8	22.6	--------	7.1	--------	59.1	30.5	--------	14.8
Any reaction	16.3	90.3	75.5	16.2	65.7	14.5	91.0	70.1	18.3	60.3
Number tested	[1] 1,948	1,327	1,138	[1] 1,818	1,102	550	391	308	[1] 523	277

[1] Includes unknown (nonreactors to 100 TU); percentages are based upon total known.

Six months after vaccination, when nearly the optimum degree of allergy might be expected, 90 percent of the white children showed some reaction to the 5 TU test, but more than half of these reactions were either of "erythema only" or induration less than 5 mm. in diameter. Only 41 percent had reactions of 5 mm. or more of induration. By the end of 3 years the percent having some reaction was 75, with only 23 percent with 5 mm. or more of induration. Before vaccination 16 percent had shown some reaction, mostly of erythema only.

Tuberculin Allergy in the Controls

While the results in the vaccinated group were unexpected because of the low level of allergy revealed, the findings among the controls were surprising because of the remarkable degree of sensitivity acquired in 3 years: among unvaccinated children, nonreactors 3 years previously to 100 TU and not subject to unusual conditions of tuber-

culous exposure, 66 percent showed some reaction to 5 TU. Though most of these responses were small, 7 percent of the group showed reactions of 5 mm. or more of induration. On the whole, the allergy of the control group was quite similar to that for the vaccinated.

Correlation of Allergy at 6 Months and 3 Years in the Vaccinated

Although the decline of allergy in the vaccinated is apparent from a comparison of the 6-month and 3-year distribution of the reactions, additional details on the nature of the change may be obtained by examining the reactions of the children retested at both 6 months and 3 years. The correlation of the tuberculin responses at the two periods is shown in appendix table 2 for each race and is presented in percentage form in table 4 for the white group.

Table 4. *Tuberculin sensitivity observed 3 years after vaccination among vaccinated persons subdivided according to their degree of reaction at 6 months, 5 tuberculin units used in both tests; sensitivity in control group at 3 years shown for comparison (Muscogee County white school children, 1947 and 1950)*

Degree of reaction at 6 months	Total		Degree of reaction at 3 years					
	Number	Percent	No reaction	Erythema only or induration < 5 mm.	Induration 5-9 mm.	Induration 10 mm. or more	Induration 5 mm. or more	Any reaction
			Percentages					
No reaction	78	100.0	42.3	51.3	6.4	0.0	6.4	57.7
Erythema only or induration less than 5 mm.	406	100.0	32 0	58.1	8.4	1.5	9.9	68.0
Induration 5-9 mm.	145	100.0	17.9	57.2	22.1	2 8	24.8	82.1
Induration 10 mm. or more	213	100 0	11 7	43.7	33.8	10.8	44.6	88.3
Total vaccinated	842	100 0	25.4	53.7	17.0	3.9	20.9	74.6
Total control group	1,102	100.0	34.3	58.6	6.3	0 8	7.1	65.7

There is a clear cut correlation between the responses at 3 years and those at 6 months. The percent with 5 mm. or more induration at 3 years ranges from 6 percent for those with no reaction at 6 months to 45 percent for those who showed 10 mm. or more induration at 6 months.

The loss of allergy, however, is quite apparent and it is most extreme among those who had the largest reactions at 6 months. Reactions at 3 years were equal to or greater than their 6 month counterparts in only 11 percent of the reactions measuring 10 mm. or more, 25 percent of the reactions of 5–9 mm. induration, and 68 percent of the reactions of small induration or erythema only. While not explicitly shown, only 37 percent of the persons who might be regarded as "reactors" (5 mm. or more of induration) at 6 months showed that much allergy at 3 years.

An important finding from table 4 is that both the vaccinated who showed no reaction and those who showed very little response at 6 months had virtually the same degree of allergy at 3 years as the control group.

Allergy Among Those Revaccinated at 6 Months

Of special interest are 68 children included in the 3-year tests who were among the 119 white children revaccinated at 6 months when they failed to show reactions of at least 5 mm. to 100 TU. This group showed much less sensitivity at 3 years than those who had not been revaccinated. They had, in fact, about the same sensitivity as the control group; 68 percent showed some reaction and only 10 percent showed reactions of 5 mm. or more of induration.

Summary and Discussion

The results presented in this paper must be judged in the light of two important, basic, and very general considerations. First, the fundamental relationship between allergy to tuberculin and immunity to tuberculosis is still a highly controversial matter. It follows, therefore, that there is no scientific basis for judging the immunological significance of BCG induced tuberculin allergy, whether it be sensitivity to a low or to a high dose of tuberculin. Second, purely empirical criteria of tuberculin sensitivity are still being used in all practical BCG programs both for selecting eligibles for vaccination and for measuring the effect of vaccination. Substantial modification of these criteria since the beginning of the Muscogee County program in 1947 obviously has important implications with respect to the interpretation of the findings reported here.

Although there was not unanimity of opinion, eligibility for BCG vaccination up until 1948 had generally been based on failure to react to 100 to 250 TU, and acceptable postvaccination allergy had been the acquisition of sufficient allergy to react to one or the other of these fairly large doses of tuberculin. During the last few years, along with increasing evidence of the "nonspecific" character of reactions to the larger doses of tuberculin, there has been a reduction in the doses used in practical BCG work. In 1950, at its 5th session, the Expert Committee on Tuberculosis of the World Health Organization recommended that a single 5 TU dose be used in mass campaigns to select candidates for vaccination (*4*). The same year Holm, Technical Director of the International Tuberculosis Campaign, says in his second annual report: "One should not be satisfied with the vaccination unless there is a high degree of allergy, which means a typical tuberculin reaction to a small dose of tuberculin (e. g. 5 TU)" (*5*).

It is not likely that all workers in the field of BCG vaccination would agree with the recommendations of the WHO Expert Committee

or with Holm's view that satisfactory postvaccination allergy should be a typical reaction to 5 TU. With respect to the latter, it is evident from the available reports on postvaccination allergy that such a high degree of tuberculin sensitivity has rarely been obtained in BCG programs in the past. On the other hand, information from the Tuberculosis Research Office of the World Health Organization indicates that such results can be obtained: almost 100 percent of several thousand Danish children have reactions larger than 5 mm. of induration to the 5 TU dose both 10 weeks and 1 year after vaccination with Danish vaccine given by the intradermal method (*6*).

It is against this background that the postvaccination tuberculin sensitivity in the Muscogee County program must be examined. The school children vaccinated in 1947 were selected according to the then current criterion that they not react to 100 TU. Post vaccination testing in 1950 was done according to a new criterion—5 TU—the one actually used in expanding the Muscogee County program and to revaccinate those who had been vaccinated in 1947. The results are clear: most of the children vaccinated in 1947 failed to show the level of tuberculin sensitivity required. Only 41 percent of the white children had reactions measuring 5 mm. or more of induration 6 months after vaccination and this percentage dropped to 23 by the end of 3 years. Even this finding must be tempered by the fact that 7 percent of a comparable group of unvaccinated controls also attained that degree of allergy at 3 years. Fairly similar results were obtained on the Negro children in the community and, taking both white and Negro children together, about 75 percent of the persons vaccinated in 1947 were revaccinated in 1950.

In terms of postvaccination tuberculin allergy the 1947 BCG vaccination program in Muscogee County cannot be regarded as fulfilling current criteria widely used throughout the world. Only time and study of the development of tuberculosis in vaccinated and unvaccinated control groups can be expected to show both the protective value of BCG and its relation to tuberculin allergy.

In its broad implications, the Muscogee County vaccination program must be recognized as one carried out in an area in which a very large proportion of the school age population shows reactions to the higher doses of tuberculin. The significance of that fact cannot be judged at the present time. Nevertheless, after 3 years the unvaccinated control group of children showed a distribution of reactions to the 5 TU test that must be regarded as reflecting the acquisition of a substantial amount of low grade tuberculin allergy, which would undoubtedly have been more clearly brought out had 100 TU postvaccination tests been given. Thus both the vaccinated and control children were subjected for 3 years to whatever factor is responsible in the locality for the remarkably high prevalence of high dose tuberculin sensitivity.

Speculations as to the effect of superimposing this factor upon BCG induced allergy might include an hypothesis that the allergy of the vaccinated would be increased—a type of "booster dose" effect. Quite the opposite effect might also be postulated, that the factor producing high dose allergy tends to reduce BCG allergy, a type of desensitization. It is of more than academic interest that in the paper which follows in this issue, the authors find it acceptable to postulate just such a desensitizing effect in order to explain differences in naturally acquired tuberculin sensitivity occurring in certain populations in India.

From the viewpoint of obtaining sound scientific knowledge on the production of tuberculin allergy by BCG vaccination, the present study brings out the tremendous importance of having equivalent observations on a comparable control group of unvaccinated persons. In the absence of the controls, it is almost certain that most of the reactions in the vaccinated would have been attributed to BCG. An entirely different conclusion is quite admissible: that there was very little residual effect of BCG after 3 years, for BCG cannot be considered as essential in producing the major part of the allergy observed.

ACKNOWLEDGMENTS

Any undertaking of this magnitude involves the cooperation and contribution of many public health administrators and research workers. The project was given approval and support by the County Health Commissioner, Dr. J. A. Thrash, and by the Director of the Division of Tuberculosis Control of the Georgia State Health Department, Dr. H. C. Schenck. Both the 1947 and 1950 field programs were accomplished under the general guidance of Dr. George W. Comstock, Tuberculosis Control Officer for Muscogee County. The field operations were under the direction of Dr. Leroy E. Bates in 1947 and under Dr. Harold S. Barrett in 1950. The nursing activities in the large 1950 survey were under the direction of Helen Gertz. The statistical processing of the data collected has been accomplished under the direction of Teresa E. Roache. This report has been prepared with the guidance and assistance of Shirley H. Ferebee and Dr. Carroll E. Palmer.

REFERENCES

(*1*) Comstock, G. W.: Tuberculosis studies in Muscogee County, Georgia. I. Community-wide tuberculosis research. Pub. Health Rep. **64**: 259–263 (1949).

(*2*) Palmer, Carroll E., Ferebee, Shirley H., and Petersen, O. Strange: Studies of pulmonary findings and antigen sensitivity among student nurses. VI. Geographic differences in sensitivity to tuberculin as evidence of nonspecific allergy. Pub. Health Rep. **65**: 1111–1131 (1950).

(*3*) Edwards, Lydia B., and Gelting, Anna S.: BCG vaccine studies. II. Effect of variation in dosage of BCG vaccine on allergy production and vaccination lesions nine weeks after vaccination. WHO Bull. **3**: 279–300 (1950).

(*4*) Report on the Fifth Session, Expert Committee on Tuberculosis. World Health Organization Technical Report Series No. 32, Geneva, 1951, p. 10.

(*5*) General Introduction to Field Operations. Prepared by International Tuberculosis Campaign Headquarters. Second Annual Report of the International Tuberculosis Campaign, Copenhagen, 1950, p. 123.

(*6*) Personal communication from Carroll E. Palmer.

Appendix table 1. *Distributions of the vaccinated and control groups by degree of reaction to 5 tuberculin units (0.0001 mg. PPD) for tests at origin, at 6 months and at 3 years after vaccination, by number and percent, for each race (Muscogee County school children, 1947 and 1950)*

Degree of reaction to 5 tuberculin units	Number of persons					Percentages				
	Vaccinated group			Control group		Vaccinated group			Control group	
	Tuberculin tested at					Tuberculin tested at				
	Origin	6 months	3 years	Origin	3 years	Origin	6 months	3 years	Origin	3 years
					WHITE					
No reaction	1,621	129	279	1,513	378	83 7	9.7	24 5	83 8	34.3
Erythema only	240	376	128	222	113	12.4	28 3	11.3	12.3	10.3
Induration (mm.)										
2	40	63	178	41	244	2.1	4.8	15 6	2 3	22 2
3	27	58	143	19	157	1.4	4 4	12 6	1.1	14 2
4	8	159	153	11	132	.4	12 0	13 4	0 6	12 0
5		42	81		44		3 2	7 1		4 0
6		68	53		11		5.1	4 7		1.0
7		55	38		9		4 1	3.3		.8
8		29	14		--------		2 2	1.2		--------
9		29	29		5		2.2	2 5		.5
10		28	20		--------		2.1	1.8		--------
11		68	4		--------		5 1	.4		--------
12		85	4		1		6 4	.4		.1
13		43	2		2		3 2	.2		.2
14		36	2		3		2.7	.2		.3
15		23	4		--------		1.7	.4		--------
16		12	2		1		.9	.2		.1
17		11	2		--------		.8	.2		--------
18		3	--------		2		.2	--------		.2
19		2	1		--------		.2	.1		--------
20		3	--------		--------		.2	--------		--------
21		1	--------		--------		.1	--------		--------
22		--------	1		--------		--------	.1		--------
23		1	--------		--------		.1	--------		--------
24		--------	--------		--------		--------	--------		--------
25		2	--------		--------		2	--------		--------
31		1	--------		--------		.1	--------		--------
Total	[1] 1,948	1,327	1,138	[1] 1,818	1,102	100.0	100.0	100.0	100.0	100.0
					NEGRO					
No reaction	470	35	92	425	110	85 5	9 0	29 9	81 7	39.7
Erythema only	52	64	28	57	32	9.5	16.4	9.1	11.0	11.6
Induration (mm.)										
2	17	11	41	19	44	3.1	2.8	13.3	3.7	15 9
3	6	6	25	10	24	1.1	1.5	8.1	1.9	8.7
4	5	44	28	9	26	.9	11.3	9 1	1.7	9.4
5		10	13		12		2.6	4.2		4.3
6		19	18		8		4.9	5 8		2.9
7		15	11		5		3.8	3 6		1.8
8		20	2		1		5.1	.6		.4
9		11	11		--------		2.8	3.6		--------
10		11	9		2		2.8	2 9		.7
11		20	8		1		5.1	2.6		.4
12		33	3		2		8.4	1 0		.7
13		25	4		1		6 4	1.3		.4
14		20	4		--------		5.1	1 3		--------
15		16	4		3		4 1	1.3		1.1
16		4	2		1		1.0	.6		.4
17		7	3		1		1.8	1.0		.4
18		4	1		1		1.0	.3		.4
19		7	1		2		1.8	.3		.7
20		4	--------		--------		1.0	--------		--------
21		2	--------		1		.5	--------		.4
22		1	--------		--------		.2	--------		--------
26		2	--------		--------		.5	--------		--------
Total	550	391	308	[1] 523	277	100.0	100.0	100.0	100.0	100.0

[1] Including unknown (nonreactors to 100 TU); percentages are based upon total known.

Appendix table 2. *Correlation of degree of reaction to 5 tuberculin units 3 years after vaccination with degree of reaction 6 months after vaccination (Muscogee County school children,*1947 and 1950)*

Degree of reaction at 6 months	Total	Degree of reaction at 3 years						
		No reaction	Erythema only	Induration, in millimeters				
				2–4	5–7	8–9	10–14	15 or more
				WHITE				
No reaction	78	33	6	34	5	-------	-------	-------
Erythema only	228	83	33	90	15	2	4	1
Induration (mm.):								
2–4	178	47	27	86	15	2	-------	1
5–7	104	20	8	49	20	5	1	1
8–9	41	6	5	21	5	2	1	1
10–14	171	23	18	62	40	20	7	1
15 or more	42	2	4	9	7	5	11	4
Total	842	214	101	351	107	36	24	9
				NEGRO				
No reaction	22	5	4	9	1	1	2	-------
Erythema only	34	17	3	9	3	-------	-------	2
Induration (mm.):								
2–4	37	15	6	13	-------	-------	1	2
5–7	28	8	4	10	6	-------	-------	-------
8–9	17	7	1	6	3	-------	-------	-------
10–14	67	15	6	21	9	4	9	3
15 or more	31	4	1	3	6	4	9	4
Total	236	71	25	71	28	9	21	11

Erratum

In the article "Body Mechanisms in Progressive Tuberculosis," by Howard Payne, M.D., Public Health Reports, vol. 66, no 40, October 5, 1951, references to "agglutination" in the last paragraph on page 1266 should have been "percipitation."

Research Contributions of BCG Vaccination Programs

II. Tuberculin Sensitivity at Different Altitudes of Residence

By LeRoy E. Bates, M.D., Thøger Busk, Cand. Act., and Carroll E. Palmer, M.D.*

For many decades, the tuberculin test has enjoyed a respectability shared by few other medical tests. Most of this respect has been justified by the test's usefulness in the diagnosis of clinical cases, its contribution to epidemiological knowledge, its value in the construction of control programs, and more recently, its integration into the vast international BCG vaccination campaigns of prevention. On the basis of such extensive application it might seem obvious that the tuberculin test is so firmly grounded on facts that even the most careful scientific scrutiny will not destroy its basic principles.

As the applications of the test widen, however, evidence occasionally appears which challenges the traditional theories regarding the test. Up to the present time, thorough investigation of these threats has contributed to our understanding of the tuberculin test and has further reinforced its fundamental principles. An outstanding illustration occurred in recent years. The reliability of the test was seriously questioned when it was proved that pulmonary calcification commonly accepted as evidence of healed tuberculosis was found in many persons who failed to react to tuberculin. The subsequent finding that most of these cases react to histoplasmin was followed by strong epidemiological, clinical, and pathological evidence that infection with the fungus *Histoplasma capsulatum*, as well as tuberculosis, is an important cause of pulmonary calcification.

At the present time one of the most persistent threats to traditional tuberculin test theory concerns the specificity and stability of tuberculin reactions to high doses (100–250 TU) among persons negative to low doses (1–5 TU). In the first place, the prevalence of high dose reactors does not appear to be associated with other evidence of tuberculosis—neither morbidity, mortality, nor the frequency of low dose reactors (which has been uniformly interpreted as representing true tuberculous infection within communities). Second, high dose reactions often differ in appearance from low dose reactions: they are pale, soft, diffuse, and, in general, less intense reactions. Third, the

*From the Tuberculosis Research Office, World Health Organization, Copenhagen, Denmark.

size of high dose reactions is reported to vary considerably in short periods of time, more so than the size of reactions to low doses of tuberculin. And finally, the prevalence of high dose reactors, though apparently unassociated with other indications of tuberculous infection, is surprisingly related to geographic factors. A large body of evidence from studies of student nurses (*1*) and school children (*2*) in widely separated areas of the United States points to this relationship.

The accumulating evidence of uncertainties in the interpretation of high dose reactions has rather serious implications. To explain this devious behavior of high dose reactions, we must do one of two things. We must sharpen our concepts of the relationship between tuberculin sensitivity and the microbiology of the tubercle bacillus, the mechanics of infection, and the physiological processes of the body that relate to allergy production; or, we must postulate the existence of an infecting agent which produces low-grade sensitivity to tuberculin, and is extremely prevalent in some areas and rare in other areas.

It is interesting that a problem so fundamentally related to tuberculin testing should appear after more than five decades of continuous application of the test, but it is not astonishing. Visualization of this problem depended on techniques and opportunities which have been at hand for only a few years. Since the problem involved a quantitative comparison of tuberculin test results in different areas, it depended on the development of standardized tuberculin products and techniques skillfully and uniformly applied by experienced personnel. It awaited, as well, the creation of research agencies with national and even international scope and the integration of research with broad national and international tuberculosis control programs.

Background of Present Study

The investigation presented here was suggested by information in reports from the Joint Enterprise [1] BCG vaccination teams working in India. Unusually high proportions of persons were reported to be reacting strongly to the second (higher) dose of tuberculin. Because a similar very disturbing situation with respect to high dose reactors had previously been observed in Louisiana, in contrast to certain other areas in the United States, the Tuberculosis Research Office of the World Health Organization recognized an opportunity to pursue this problem of geographic variations in tuberculin sensitivity on a much wider basis.

An experienced BCG research team composed of a doctor, nurse, and statistician was assigned the task of collecting precise, quantitative information on tuberculin sensitivity in various places in India. An

[1] A cooperative enterprise between Scandinavian Relief Organizations and UNICEF with technical assistance from WHO.

area around the Indian town of Darjeeling was selected as the locale of one investigation. A portion of the findings of the investigation in this area is reported here since it demonstrates remarkable differences in tuberculin sensitivity at different altitudes of residence. The nature of these differences indicates that the problem of varying patterns of tuberculin sensitivity is broader than originally supposed and invites serious thought and continued investigation.

Location of Study

Darjeeling is an Indian town situated high in the Himalayan foothills about 300 miles north of Calcutta. It is within a few air miles of the borders of Nepal, Bhutan, and Tibet and lies at the end of a mountain ridge which drops away precipitously from the town in three directions. From the valley beds at 1,000 feet to the crest of the ridge at 7,000 feet the mountain side is dotted with tea plantations. Laborers and their families on nine of these tea gardens were tuberculin tested and vaccinated with BCG.

The map shown in figure 1 gives the altitude curves for the region and shows the positions of eight of the nine tea gardens chosen for testing. The ninth garden, Ambootia, lies about 15 air miles to the south. The gardens, belonging to two tea companies are listed in table 1, along with their altitudes based on the level at which the majority of the workers live. Although their altitudes differ widely eight of them lie almost entirely within a circle having a radius of only 3 air miles.

Population Chosen for Study

The population chosen for testing was composed of tea-garden workers and their families. About one-third of the total population in each tea company was tested. In one company, persons from 0 to 20 years of age were selected for study; in the other, persons from 5 to 25 years of age were selected. In general, male and female children work from the age of 12; consequently nearly half the population are workers. The population and the number tested in each garden are given in table 1. The age distribution is given in table 2. The number of males and females was approximately equal.

As far as is known, tests were given to practically everyone in the age groups chosen for testing, and about 90 percent of the tests were completed (table 1).

The majority of the tea laborers are Nepalese people of Mongolian race. They are small in stature and work hard from a very young age. Their faiths vary. About 13 percent are Buddhists; a very few are Christians or Moslems. The rest, the major portion, are Hindus who, however, apparently do not adhere so strictly to vegetarianism as do the Hindus in other parts of India.

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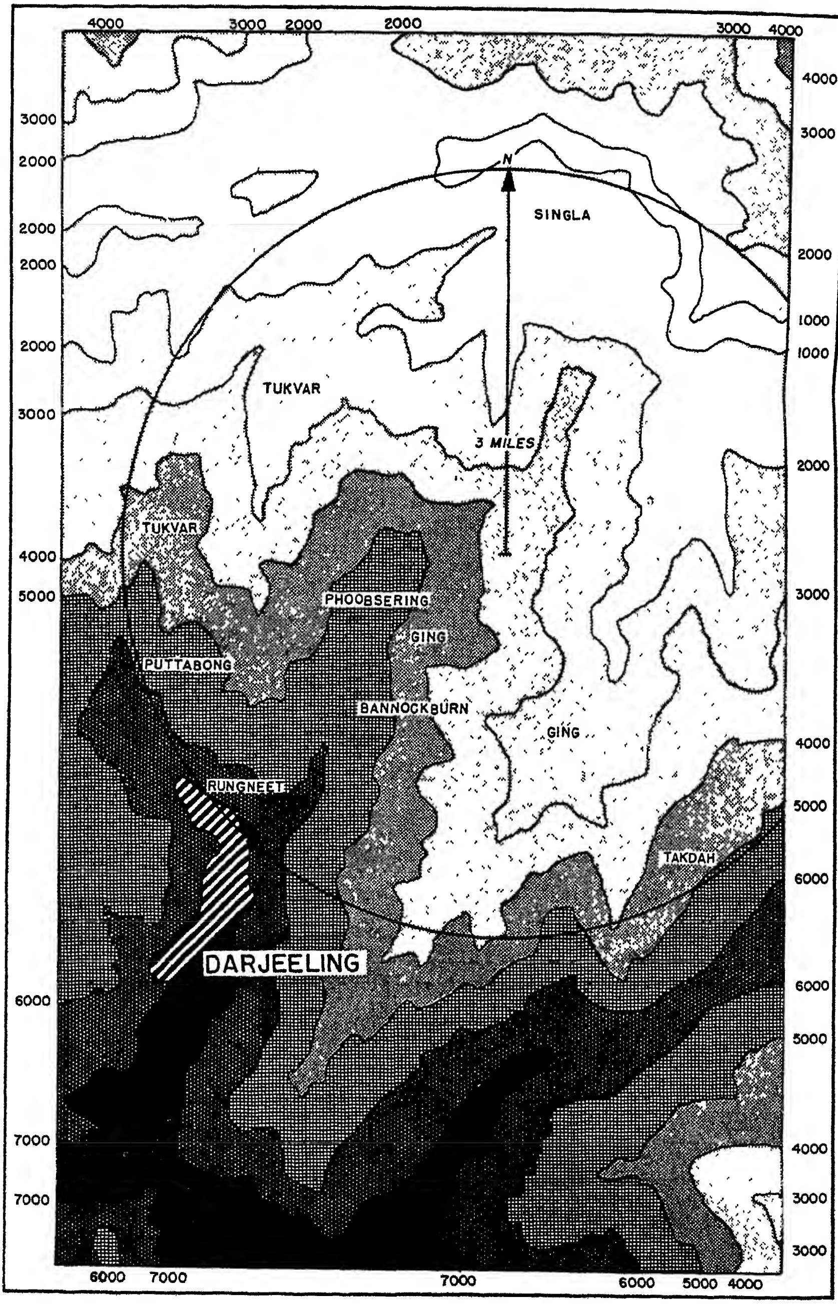

Figure 1. Topographic map showing the location and elevation of eight of the nine tea gardens where tuberculin tests were given, Darjeeling, 1949–50.

Table 1. *Extent of tuberculin testing in tea gardens grouped by altitude, Darjeeling, 1949–50*

Garden [1]	Altitude above sea level (feet)	Population [2]	Persons 0–24 years: Tested with 1 TU	Testing completed [3]	Percent testing completed
Low altitude					
Singla	2,000	1,553	499	395	79
Ging, lower	2,600	1,366	399	394	99
Ambootia	3,000	1,911	597	554	93
Tukvar, lower	3,300	1,019	325	286	88
Total		5,849	1,820	1,629	90
Middle altitude					
Bannockburn	4,500	909	347	333	96
Tukvar, upper	4,600	1,710	545	513	94
Ging, upper	4,800	726	212	204	96
Takdah	5,000	1,641	508	458	90
Total		4,986	1,612	1,508	94
High altitude					
Phoobsering	5,500	993	307	268	87
Puttabong	5,500	913	374	309	83
Rungneet	6,500	513	185	150	81
Total		2,419	866	727	84
Total for all gardens		13,254	4,298	3,864	90

1 Puttabong, Tukvar, and Singla tea gardens belong to 1 tea company while the 6 other tea gardens belong to a second tea company.
2 Based on census taken within 6 months of testing. Division of population on upper and lower parts of Tukvar and Ging is estimated.
3 10 and/or 100 TU tests were given if required and all reactions were read within 4 days.

Frequently four to six persons live in a hut 10 x 20 feet which is usually built directly on the ground with walls of plank or of bamboo plastered with earth. They have roofs of thatch or of corrugated iron sheeting. The huts are dark and poorly ventilated and very often their small windows are deliberately covered by the occupants. During the very heavy rains that occur in the monsoon seasons, the houses afford but moderate protection.

Table 2. *Number of persons tested with 1, 10, and 100 TU, by age and altitude of residence, Darjeeling, 1949–50*

Age in years	1 TU			10 TU			100 TU		
	Altitude								
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Reactions read:									
0–4	160	171	109	138	160	98	125	157	90
5–9	328	329	166	254	264	136	208	249	122
10–14	520	547	224	369	382	155	233	319	127
15–19	487	356	205	322	206	109	147	141	98
20–24	226	163	77	96	79	36	34	40	28
Total	1,721	1,566	781	1,179	1,091	534	747	906	465
Reactions not read	99	46	85	36	42	24	56	16	30
Total tested	1,820	1,612	866	1,215	1,133	558	803	922	495

The majority of the tea laborers go barefooted most of their lives. Hookworm and respiratory ailments are common. Malaria is said to be frequent at the low altitude, but rare above 3,500 to 4,000 feet. In the six gardens belonging to one of the tea companies, the crude death and birth rates for the year 1948 were 2 and 4 percent, respectively.

Materials and Methods

The work of the team was carried out in accordance with a protocol carefully prepared in advance. In addition, all necessary supplies were new and carefully cleansed, packed, and sterilized in the headquarters office in Copenhagen.

The tuberculin used for testing was part of a lot of purified protein derivative (No. RT XIX–XX–XXI) prepared by the State Serum Institute at Copenhagen. Three different doses were given as follows: the 1 unit test (0. 00002 mg.) was given to all persons in the study group. The 10 unit test (0.0002 mg.) was given only to those persons who had reactions of less than 6 millimeters of induration to the 1 TU test. The 100 unit test (0.002 mg.) was given only to persons who had reactions of less than 6 millimeters of induration to the 10 TU test. The dilutions of tuberculin were carefully prepared in the field from a concentrated stock solution using pipettes. In no instance were the dilutions used longer than 16 days after preparation.

The tuberculin tests were given intradermally in the upper half of the volar surface of the forearm. One-tenth of a cubic centimeter of diluted tuberculin was carefully measured from a tuberculin syringe for each injection. Only reactions which were read at 3 or 4 days are used in this study. The widest transverse diameter of both erythema and induration was measured in millimeters, and the density of the reactions was graded in four qualitative categories. Both the team doctor and the nurse gave injections but all reactions were read by the team doctor. The entire testing and vaccination program in the Darjeeling area was carried out in the period from December 27, 1949, to February 8, 1950.

Findings

Detailed data on the results of tuberculin testing are given in appendix table 1. Text tables 3 and 4 and figures 2, 3, and 4 are presented to summarize the data and to bring out the striking differences in the patterns of tuberculin sensitivity that are associated with altitude of residence and age of the tested populations.

The section to the left in figure 2 shows, separately for each altitude of residence, the change with age in the percentages of the population designated as positive reactors to the 1 TU dose of tuberculin, according to the usual criteria of more than 5 mm. of induration. Among

Table 3. *Percentage of reactors [1] among nonreactors to previous tuberculin test, by age and altitude of residence, Darjeeling, 1949–50*

Age in years	1 TU			10 TU			100 TU		
	Altitude								
	Low	Medium	High	Low	Medium	High	Low	Medium	High
0–4	8.1	5 3	4 6	2.2	1.2	0.0	16.8	5 1	3 3
5–9	19.8	15.5	13.3	9.1	2.7	4.4	44 7	22.1	10.7
10–14	26.7	26 7	28.1	33.6	15.2	9.7	72.5	40 8	19.7
15–19	32.9	40.4	45.4	50.9	30.6	9.2	89 8	64.5	31.6
20–24	57.1	50.9	51 0	64.6	49.4	22.2	94 1	75.0	46 4

[1] A reactor is defined as a person with a reaction of more than 5 mm. induration.

children under 5 years of age, in all altitudes, about 5 percent had reactions of more than 5 mm. of induration to this first low dose of PPD. For the age group 20 to 25 years, the frequency of such reactions increases to about 50 percent. While there are some systematic fluctuations in the age curves it is obvious that altitude of residence does not markedly influence the frequency of reactions ordinarily designated as positive to the 1 TU test.

Table 4. *Combined distributions of reactions to 1, 10, and 100 TU, by age and altitude of residence (percentages [1])*

Mm. of induration	Dose (TU)	Low altitude			Middle altitude			High altitude		
		Age in years								
		0–9	10–14	15–24	0–9	10–14	15–24	0–9	10–14	15–24
0–5	100	51.6	13.4	2.6	72.7	36.9	12 0	81.3	52.1	30.1
6 and over	100	26.9	35 3	24.7	13 4	25.3	24.1	6.6	12.8	16.1
6 and over	10	5 6	24.6	32.1	1.9	11.1	20 1	2.3	6 9	6 6
6–11	1	6.1	12.5	27.1	3.4	11.3	22.2	4.0	5.4	11.0
12 and over	1	9.8	14.2	13.5	8.6	15.4	21.6	5.8	22 8	36 2
Total		100.0	100.0	100.0	100.0	100.0	100 0	100.0	100.0	100.0

[1] The percentages are calculated under the assumption that the reactions not read were distributed in the same way as those read.

The middle section of figure 2 shows the age curves of percentage of reactors (more than 5 mm. of induration) to 10 TU among those not designated as positive reactors to 1 TU. Similar age curves for the 100 TU dose of tuberculin, among nonreactors to 10 TU, are shown in the right hand section of the figure. The enormous influence of altitude of residence on the frequency of reactors to the two larger doses of tuberculin is clearly apparent. As illustrations it may be noted that for the age group 20–25, less than 25 percent of the population living at altitudes above 5,500 feet react to 10 TU, while more than 60 percent of those of similar age react if they live at elevations less than 3,300 feet; among nonreactors to 10 TU, 20-25 years of

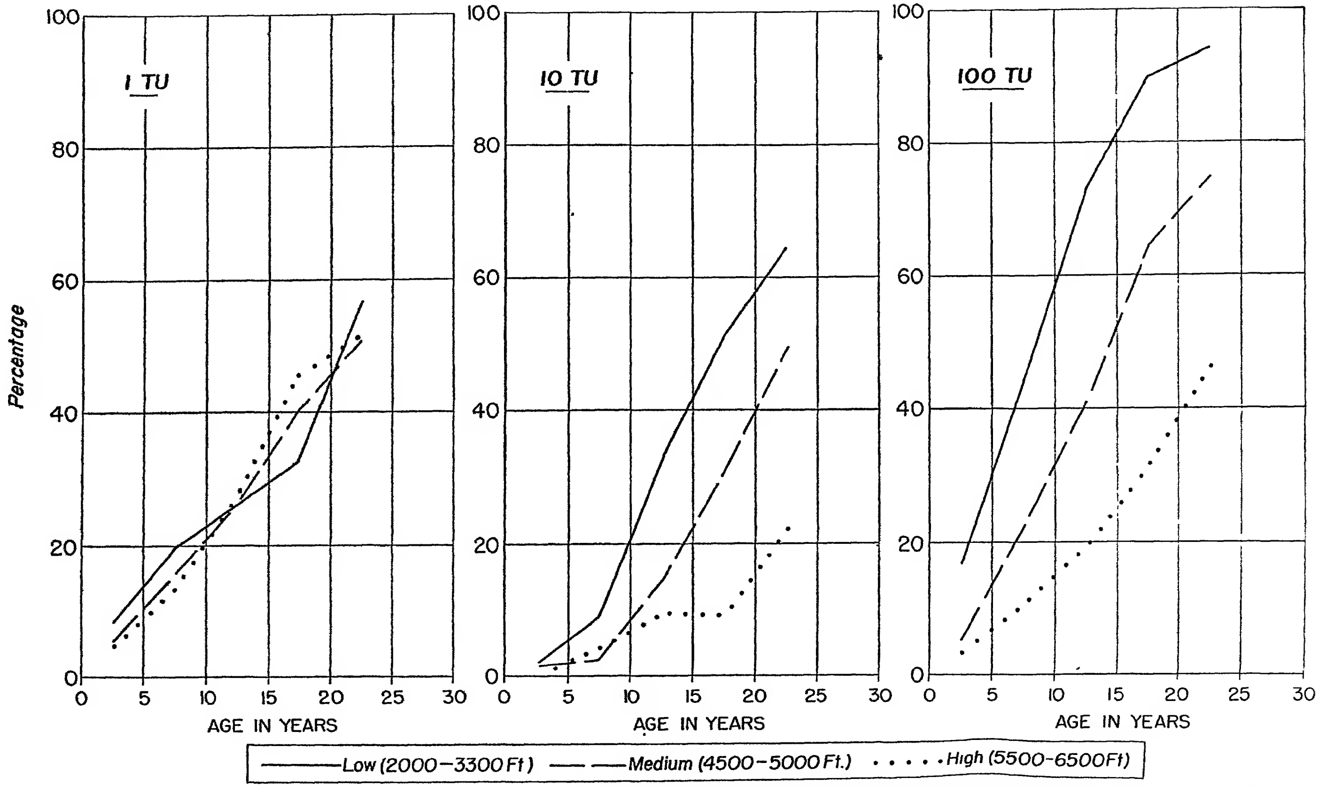

Figure 2. Percentage of reactors among nonreactors to previous tuberculin test, by age and altitude of residence, Darjeeling, 1949–50.

age, 46 percent react to 100 TU if they live above 5,500 feet while nearly 95 percent react if they live below 3,300 feet.

In general, it is evident that there is a marked association between altitude of residence and the frequency of reactors to the 10 and 100 TU doses of tuberculin: the higher the place of residence above sea level the lower the prevalence of reactors to these doses. Further, with increase in the age of the persons tested there are very sharp increases in the frequencies of these reactors, especially of those to the 100 TU test.

Only part of the important differences in the pattern of tuberculin sensitivity according to altitude are brought out by a consideration simply of the prevalence of "positive" reactors to the three graded doses of tuberculin. In figure 3, histograms illustrating the frequency distributions of the measured sizes of reactions are shown for five age groups, for each dose of tuberculin, and for the three altitude groups. Inspection of these 45 histograms reveals several significant facts. First, although the percentages of reactors designated as positive to the 1 TU test are not very different for residents at different altitudes, the distributions of sizes of reactions show sharp contrasts. The characteristic tendency may be noted by comparing, for example, the distribution of reactions to 1 TU for 15–19-year-old children living at high and low altitudes. The distribution for the low altitude group is J-shaped; the most frequent class is that having reactions of 0–2 mm. in diameter, with a gradual decrease in frequency of the larger reactions. Very few children have reactions of 15 mm. or more. The distribution for the high altitude group shows an entirely different pattern. While the 0–2 mm. class contains the greatest number of cases, the remainder of the distribution appears to have the form of a "normal" frequency curve with its mode for the class having reactions 12–14 mm. in diameter. A substantial proportion of the children have reactions measuring 15 mm. or more in diameter. Although it is less apparent for the younger children, there is a general tendency for the size of the 1 TU reactions to be somewhat smaller the nearer the residence of the child is to sea level.

Comparison of the distributions of 100 TU reactions for children 15–19 years of age living at the high and low altitudes reveals a complete reversal in the pattern of sizes of reactions. For this dose of tuberculin the J-shaped form of distribution is found for the high altitude residents while a distribution somewhat similar to a normal curve is found for those living at the low altitude. Thus, it appears that with increasing age there is a tendency for J-shaped distributions to appear for 1 TU tests at the low altitude and for 100 TU tests at the high altitude. Frequency distributions resembling the form of normal curves tend to appear for 1 TU tests at the high altitude and for 100 TU tests at the low altitude.

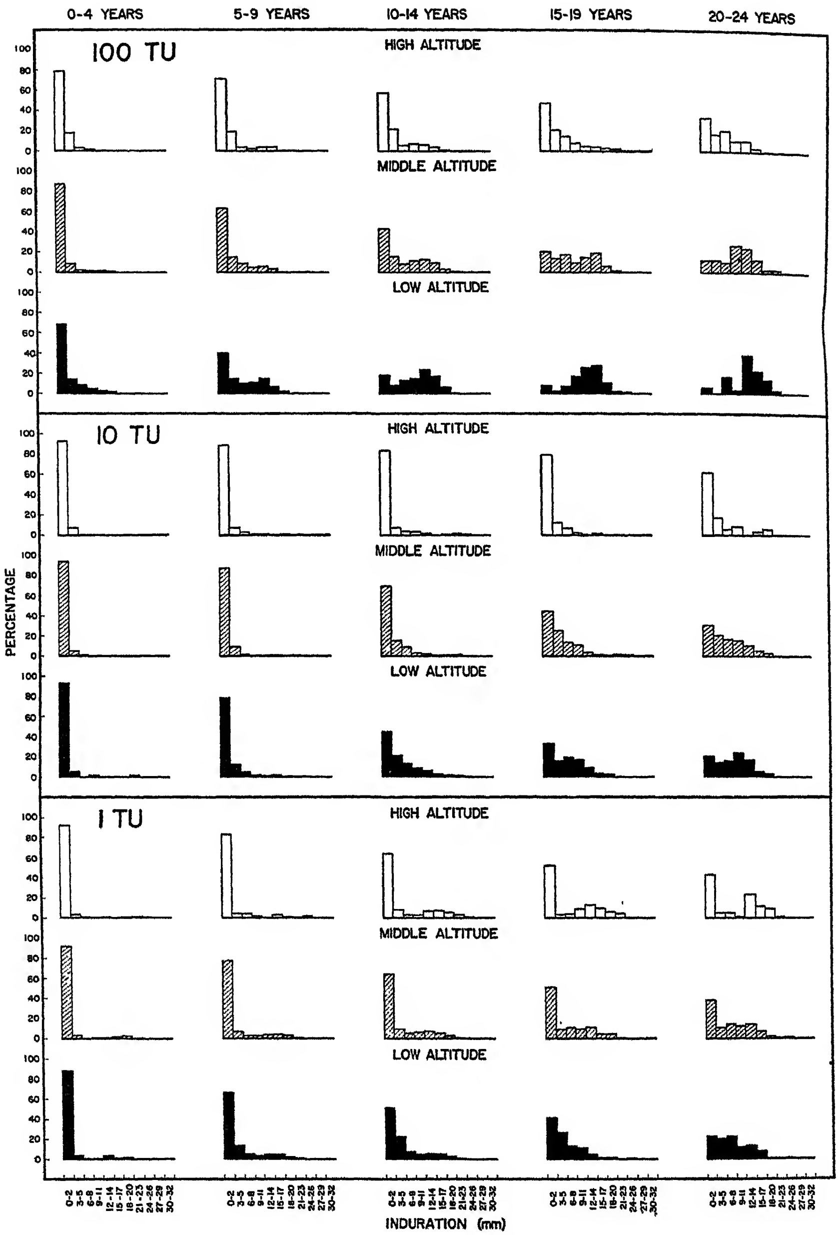

Figure 3. Percentage distribution of reactions in millimeters of induration to each dose of tuberculin by age and altitude of residence, Darjeeling, 1949–50 (derived from appendix table 1).

The detail presented in figure 3 suggests another significant fact: the form of the distribution of 1 TU reactions may be useful in predicting the pattern of sensitivity to the higher doses of tuberculin. Thus it appears that the presence of many 3–5-mm. reactions to the 1 TU test, as revealed in the J-shaped distributions for low-altitude residents, is associated with the finding of many reactors to the higher doses of tuberculin. Relatively few small reactions to 1 TU, as observed among high-altitude residents, indicate the absence of many reactors to the higher doses of tuberculin. This finding probably means that fairly strong reactors to the higher doses, even 100 TU reactors, tend to reveal their presence by showing small reactions below the size usually regarded as positive to the less concentrated doses of tuberculin.

In order to show altitude differences for the whole range of tuberculin sensitivity, table 4 and figure 4 present distributions of the frequency of reactions according to five broad classes for three age groups for each altitude of residence. For these distributions reactions to the 1 TU are subdivided arbitrarily into those measuring more than 11 mm. of induration and those 6–11 mm. in diameter; all reactions larger than 5 mm. to the 10 TU are placed in a single class; 100 TU reactions are subdivided into two classes, those above 5 mm. in diameter and those showing 5 mm. or less of induration.

Differences between the distributions are apparent to some extent in the youngest age group but these differences are in general limited to the frequencies of 100 TU reactions. With increasing age, however, a gradual shift from smaller to larger reactions occurs and at the same time the various altitudes develop singularly diverse patterns. Maximum differences in the pattern of tuberculin allergy may be noted by comparing the upper and lower histograms shown at the right side of figure 4. In the upper histogram, for the group 15–24 years of age living at an altitude above 5,500 feet, the distribution is clearly U-shaped. There are many large reactions to 1 TU, many small reactions less than 6 mm. to 100 TU, and few of those representing intermediate degrees of allergy, particularly reactions to 10 TU. The lower histogram, for 15-24-year olds living less than 3,300 feet above sea level, is strikingly different. It is unimodal, with most of the population showing the intermediate degrees of tuberculin sensitivity, the most frequent reactions being those to the 10 TU test.

Discussion

The population dealt with in this investigation comprised groups of persons comparable with respect to race, age, sex, and major habits of life. Persons in the age groups studied were exceedingly restricted in their travel. As far as could be determined by inquiry the preva-

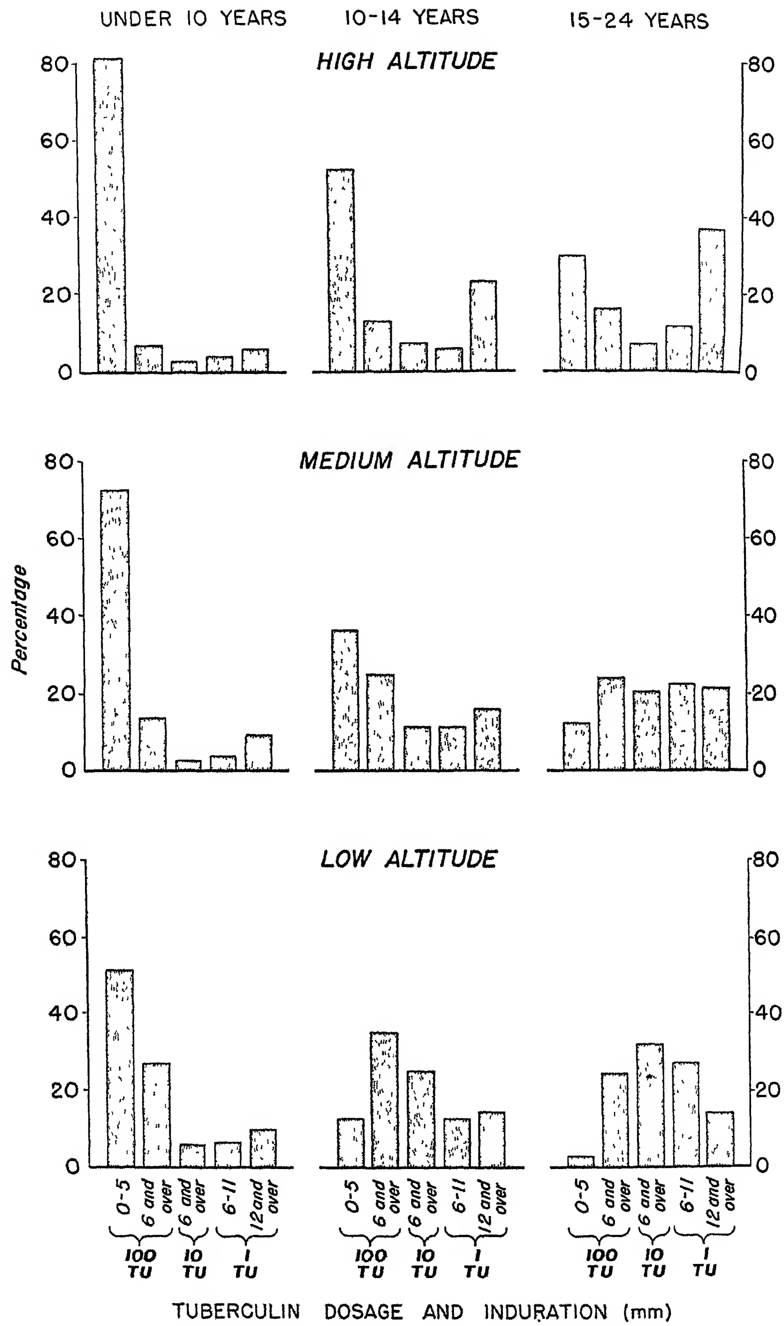

Figure 4. Combined distributions of reactions to 1, 10, and 100 tuberculin units by age and altitude of residence, Darjeeling, 1949–50.

lence of tuberculosis was the same throughout the whole area. Consequently, so far as is known the difference in altitude of residence is the most obvious single variable in the population.

Many factors—constitutional make-up of the people, dosage and mechanism of infection, inherent characteristics of the infecting organism—may be pertinent in attempts to explain the observed variations in tuberculin sensitivity. It is possible that environmental factors, such as climate, affect the quantity or the quality of infecting organisms or that different modes of infection may occur at different altitude levels. It is conceivable also that fundamental differences in allergic response to tuberculous infection may occur in persons living at different altitudes. But considerations of how these factors could produce such large variations predominantly in sensitivity to the higher doses of tuberculin without producing greater change in sensitivity to the low dose or without an obvious influence on tuberculosis morbidity and mortality, become so complex that one is tempted to seek other and perhaps simpler explanations of this phenomenon.

The common occurrence of cross reactions among skin testing antigens, and the similarity between the pattern of sensitivity produced in cases of known cross reactions and the pattern of sensitivity found in the low altitude at Darjeeling (and in certain other regions) suggest that some of the sensitivity to tuberculin observed in these locations may be due to infection with an agent other than the ordinary human strain of tubercle bacillus.

Furthermore, the patterns of tuberculin sensitivity observed at the high and low altitudes in Darjeeling resemble those found in student nurses in widely separated geographic areas in the United States, for example, in Philadelphia and Louisiana. Since regional differences in the United States could not be adequately explained by differences in the prevalence of tuberculosis morbidity and mortality, the possibility of a nonspecific infection by some agent closely resembling and antigenically related to the tubercle bacillus was offered as an explanation (*1*). It is possible that the same type of nonspecific infection may exist in the Darjeeling area.

In an area where a nonspecific agent is present it is reasonable to expect that some persons will be infected with both the tubercle bacillus and the "nonspecific" agent. If it is supposed that the tuberculin sensitivity of such individuals is increased by the double infection, there should be relatively more large reactions (a higher level of sensitivity) to the low dose of tuberculin in areas where the nonspecific infecting agent is most prevalent, other factors in the two communities being the same. In this study the opposite is true; there are relatively more large low dose reactions at the higher altitudes where the nonspecific theory assumes that there are fewer non-

specific reactions. To conform to the patterns of sensitivity observed in Darjeeling, the nonspecific theory must now postulate that infection with both the nonspecific agent and the tubercle bacillus does not result in higher sensitivity but, in fact, results in diminished sensitivity. The idea that persons first infected and sensitized by the nonspecific agent resist further development of allergy upon subsequent infection with the tubercle bacillus or that persons first infected and sensitized by the tubercle bacillus are partially desensitized by subsequent infection with the nonspecific agent, merits consideration in the light of the experience in Darjeeling.

While the nonspecific theory is offered as the most probable explanation of these findings, the main purpose of this paper is to report that remarkable real differences in the patterns of tuberculin sensitivity do occur in a homogeneous population living in close proximity but at different altitudes. The people studied live within a few air miles of one another in a type of mountainous country where transportation difficulties and economic conditions are such that most of the people spend their lives very close to their homes on the tea plantations. Yet, within such a homogeneous group, great differences are found in tuberculin sensitivity at different altitudes of residence.

These findings are not explained adequately by any of our traditional notions of how tuberculous infection and allergy production operate. A proper explanation would contribute to the value of the tuberculin test and might lead to substantial contributions in the general field of allergy.

Summary

A homogeneous population of about 4,000 persons, 0–25 years of age, from tea plantations of a small mountainous area around Darjeeling in northern India, was tested serially with graduated doses of 1, 10, and 100 units of tuberculin. Very marked differences in the pattern of allergy were shown to exist at different altitudes of residence. While the frequency of reactions designated as positive to the 1 unit test were approximately the same at all altitudes, reactions to this dose tended to be larger at the high altitude. With the 10 and 100 unit tests a remarkably higher proportion of reactors occurred at the lower altitudes.

The hypothesis is offered that these variations in sensitivity at different altitudes, resembling those found in different areas in the United States, are due to the presence in the lower altitudes of a very prevalent, nonpathogenic organism, closely related to the tubercle bacillus, which produces sensitivity to tuberculin. It is further speculated that infection with both the nonspecific organism and the tubercle bacillus results in a lower level of sensitivity than that produced by the tubercle bacillus alone.

The material also suggests that the general form of a 1 unit distribution of reactions may be useful in predicting the pattern of sensitivity to the higher doses of tuberculin.

The investigation illustrates the opportunities that exist for wider geographic research and the value of carefully planned and executed studies which take advantage of these opportunities.

ACKNOWLEDGMENTS

Grateful acknowledgments are made to various members of the staff of the Tuberculosis Research Office, World Health Organization, and of the Field Research Branch, Division of Chronic Disease and Tuberculosis, Public Health Service, who offered suggestions and technical assistance in the preparation of the report. The investigation was especially dependent on Birthe Johansen, Tuberculosis Research Office nurse, for careful and untiring work in the collection of the original field data, and on Dr. Lydia B. Edwards, Chief of Field Operations, Tuberculosis Research Office, for valuable assistance in the planning and conduct of the study. We are indebted to the managers of the tea estates and the Indian authorities for their generous cooperation and in many instances their active assistance.

REFERENCES

(*1*) Palmer, Carroll E.; Ferebee, Shirley H.; and Petersen, O. Strange: Studies of pulmonary findings and antigen sensitivity among student nurses. VI. Geographic differences in sensitivity to tuberculin as evidence of nonspecific allergy. Pub. Health Rep. **65**:1111–1131 (1950).

(*2*) Tuberculosis studies in Muscogee County, Ga. IV. To be published.

Appendix table 1. *Distributions of tuberculin reactions in millimeters of induration, by age, dose of tuberculin, and altitude of residence, Darjeeling 1949–50*

Mm. induration	Low altitude					Middle altitude					High altitude				
	Age in years														
	0–4	5–9	10–14	15–19	20–24	0–4	5–9	10–14	15–19	20–24	0–4	5–9	10–14	15–19	20–24
100 TU dose															
0–2	86	84	44	12	2	137	157	139	30	5	71	86	75	47	10
3–5	18	31	20	3		12	37	50	20	5	16	23	27	20	5
6–8	11	21	31	11	6	3	21	26	25	4	2	4	6	14	6
9–11	6	23	34	25	1	2	11	34	13	10	1	2	8	7	3
12–14	2	31	53	38	13	2	14	37	19	9		3	7	4	3
15–17	2	14	37	39	7	1	8	26	25	5		4	3	3	1
18–20		4	13	15	4			5	7	1			1	2	
21–23			1	3	1			2	2	1				1	
24–26				1			1								
Total	125	208	233	147	34	157	249	319	141	40	90	122	127	98	28
10 TU dose															
0–2	128	200	166	106	20	150	232	266	91	24	91	120	129	86	22
3–5	7	31	79	52	14	8	25	58	52	16	7	10	11	13	6
6–8		12	51	64	16	2	3	35	28	13		3	5	7	2
9–11	2	4	31	56	22		1	9	22	12		1	4	2	3
12–14		2	22	27	16		1	7	6	8		1	2		
15–17		4	9	10	5			1	2	4				1	1
18–20		1	7	7	3		1	2	1	2		1	1		2
21–23	1		2				1	4	2				2		
24–26			2						2				1		
Total	138	254	369	322	96	160	264	382	206	79	98	136	155	109	36
1 TU dose															
0–2	141	218	266	200	51	157	256	349	180	62	100	137	143	106	33
3–5	6	45	115	127	46	5	22	52	32	18	4	7	18	6	4
6–8	1	17	40	62	50		8	28	38	23	1	7	6	8	4
9–11	1	11	25	54	27	1	8	34	34	20		3	6	18	1
12–14	6	15	29	25	31	1	11	40	40	23	1	1	14	26	18
15–17	2	14	27	7	18	3	13	26	15	11		5	16	20	9
18–20	3	6	15	9	1	4	9	14	15	3	1	2	12	12	7
21–23		2	2		1		2	4	1	1	1	1	7	9	1
24–26				3	1					2	1	3	2		
27–29															
30–32			1						1						
Total	160	328	520	487	226	171	329	547	356	163	109	166	224	205	77

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended October 6, 1951

In reports of malaria, transmitted through the Kentucky State Health Department from two military establishments located in that State, it was shown that the first cases were recognized late in March in one establishment and late in April in the other. A peak in the number of cases reported was reached late in August in both establishments. Total cases reported from these sources in Kentucky since September 1 suggest a secondary peak late in September. The reports indicate that vivax infections only have been recognized.

For the current week the number of cases of malaria classified as civilian was 55 as compared with 47 for the previous week. Of the 55 cases, 25 were reported by Georgia, 22 by Wisconsin, 5 by Texas and 1 case each by Kentucky, Oregon, and California. The 440 cases of malaria from military establishments for the current week include 283 reported from New Jersey. A large proportion of the 283 cases are delayed reports according to information received from the New Jersey Department of Health.

Poliomyelitis incidence decreased 20 percent in the current week as compared with the previous week. The rate of decline at this period of 1951 is slightly more than it was in 1950. The cumulative total for the calendar year is now 22,791 as compared with 24,937 for the same period last year, and the cumulative total since the seasonal low week is 21,579 as compared with 23,806.

For the current week 33 States reported fewer cases than for the previous week, 5 reported no change, and 10 States reported 1 to 13 more cases. Wisconsin showed the largest numerical decrease from 102 cases for the week ended October 6 to 64 cases for the current week.

Epidemiological Reports

Gastroenteritis

Dr. R. F. Feemster, Massachusetts Department of Health, has reported an outbreak of gastroenteritis in a mental disease hospital in which the custard of a Boston cream pie was the vehicle of infection. This article of food was kept at room temperature about 3 hours

before serving. None was available for bacteriological examination.

Dr. M. Goodman, New York State Department of Health, has reported an outbreak of food intoxication in an institution, involving 56 patients and 31 of the personnel. Symptoms appeared 2 to 4 hours after eating a salad containing several sea foods, eggs, and mayonnaise. Of those eating the salad, 56 percent became ill, while the attack rate among those not eating the salad was 1.6 percent. *Staphylococcus aureus* and an organism having the characteristics of *Bacillus subtilis* were recovered from this article of food.

Dr. F. D. Yoder, Wyoming Health Officer, has reported an outbreak of staphylococcus food poisoning following the eating of chicken salad sandwiches at an auction sale. In the investigation by Dr. O. C. McCandless, it was found that 75 persons were ill, 28 of whom were hospitalized, out of a total of 500 to 600 who attended the sale. The food was prepared 24 hours before being eaten and was not refrigerated. *Staphylococcus aureus* was recovered from a specimen of the food.

Dr. G. W. Cox, Texas Health Officer, has reported a small outbreak of staphylococcus food poisoning in Travis County following the eating of chocolate eclairs. A hemolytic staphylococcus was recovered from eclairs collected from three sources—a home, the bakery, and the mix from which they were prepared.

Anthrax

Dr. L. L. Parks, Florida Board of Health, has reported a case of

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Oct. 13, 1951	Oct. 14, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	1	3	1	(1)	(1)	(1)	(1)	48	36	41
Diphtheria (055)	117	171	287	27th	[2] 960	1,347	2,421	[2] 2,968	4,475	7,031
Encephalitis, acute infectious (082)	18	27	19	(1)	(1)	(1)	(1)	835	763	515
Influenza (480–483)	245	734	734	30th	3,357	4,796	4,796	119,412	143,560	132,188
Measles (085)	1,212	698	779	35th	5,833	3,606	3,685	474,744	291,777	556,638
Meningitis, meningococcal (057.0)	58	69	58	37th	209	226	189	3,270	3,025	2,823
Pneumonia (490–493)	538	895	(3)	(1)	(1)	(1)	(1)	49,838	66,780	(3)
Poliomyelitis, acute (080)	1,016	1,596	1,122	11th	21,579	23,806	21,160	22,791	24,937	21,510
Rocky Mountain spotted fever (104)	8	10	8	(1)	(1)	(1)	(1)	310	441	526
Scarlet fever (050)[4]	567	659	873	32d	3,277	3,576	4,670	56,663	43,746	61,544
Smallpox (084)	------	------	------	35th	------	1	3	11	27	51
Tularemia (059)	12	6	15	(1)	(1)	(1)	(1)	536	745	784
Typhoid and paratyphoid fever (040, 041)[5]	78	76	76	11th	2,085	2,332	2,705	2,520	2,842	3,166
Whooping cough (056)	822	1,328	1,328	39th	1,651	2,905	2,905	55,426	100,100	78,899

[1] Not computed. [2] Deduction: District of Columbia, 1 case for week ended September 22. [3] Data not available. [4] Includes cases reported as streptococcal sore throath. [5] Includes cases reported as salmonellosis.

anthrax in a person, living in Broward County, who had skinned a cow. Laboratory test from the patient as well as examination of the organs of the cow revealed the presence of the organism. It is also reported that 100 cattle have died of anthrax in the same area of Florida. The human case was the first in the state of Florida since 1941, and the disease among animals had not been observed in the immediate area for a number of years.

Infectious Hepatitis

Dr. Goodman, New York State Health Department, reports the occurrence of infectious hepatitis in three members of a family consisting of five persons. The onsets were June 26, August 2, and September 7. The source of infection of the first case was not determined.

970389—51——3

Reported Cases of Selected Communicable Diseases: United States, Week Ended Oct. 13, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**117**	**18**	**245**	**1,212**	**58**	**538**	**1,016**
New England	**1**		**1**	**138**	**2**	**21**	**14**
Maine	1			41		3	1
New Hampshire				3	1	1	
Vermont				12			
Massachusetts				58			3
Rhode Island				11	1		1
Connecticut			1	13		17	9
Middle Atlantic	**6**	**2**	**3**	**366**	**5**	**74**	**104**
New York	3	1	(1)	210	3		54
New Jersey	1	1	3	48	1	53	16
Pennsylvania	2			108	1	21	34
East North Central	**3**	**1**	**10**	**236**	**10**	**39**	**282**
Ohio	2			36	1		66
Indiana	1	1	7	10		1	12
Illinois			3	48	3	24	65
Michigan				69	6	14	75
Wisconsin				73			64
West North Central	**2**	**1**	**2**	**27**	**5**	**19**	**102**
Minnesota	1			1		2	30
Iowa				5	2		8
Missouri	1			3	1	1	16
North Dakota			2	8	1	14	4
South Dakota				1			3
Nebraska				3			17
Kansas		1		6	1	2	24
South Atlantic	**48**		**13**	**112**	**8**	**126**	**57**
Delaware							
Maryland				59		52	5
District of Columbia			1		1	17	1
Virginia	3			24		50	14
West Virginia	2			11	4		12
North Carolina	16			4			7
South Carolina	11		10			1	2
Georgia	13		2	9		6	10
Florida	3			5	3		6
East South Central	**28**	**2**	**2**	**46**	**18**	**41**	**94**
Kentucky	5			17	4	17	10
Tennessee	8	1		7	12		28
Alabama	15			8	2	5	14
Mississippi		1	2	14		19	42
West South Central	**26**		**108**	**26**	**4**	**153**	**115**
Arkansas	1		61	5	3	18	16
Louisiana	3					4	14
Oklahoma	5		47	1		16	29
Texas	17			20	1	115	56
Mountain	**3**		**66**	**142**		**20**	**96**
Montana				80			5
Idaho				5			13
Wyoming				2		2	15
Colorado	2		8	9		3	30
New Mexico				24		7	5
Arizona	1		58	7		8	11
Utah				15			16
Nevada							1
Pacific		**12**	**40**	**119**	**6**	**45**	**152**
Washington			18	25		1	10
Oregon			12	20	1	14	17
California		12	10	74	5	30	125
Alaska							
Hawaii			66	121			

[1] New York City only.
Anthrax: Massachusetts, 1 case.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Oct. 13, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	8	567		12	78	822	112
New England		44			2	59	
Maine						10	
New Hampshire		8				2	
Vermont		2				4	
Massachusetts		31			1	36	
Rhode Island		1			1		
Connecticut		2				7	
Middle Atlantic		67			8	144	21
New York		38				62	13
New Jersey		12				39	
Pennsylvania		17			8	43	8
East North Central		169			8	186	14
Ohio		56			5	56	4
Indiana		11			1	19	8
Illinois		33			2	38	
Michigan		56				36	
Wisconsin		13				37	2
West North Central		36		1	4	20	14
Minnesota		9				4	7
Iowa		5			1	1	1
Missouri		12		1	3	13	2
North Dakota		3					
South Dakota		2					
Nebraska							3
Kansas		5				2	1
South Atlantic	2	86		3	20	70	19
Delaware		2					
Maryland	1	9				16	
District of Columbia		6				1	
Virginia		9		1	5	5	
West Virginia		5				14	1
North Carolina	1	47		2	4	8	
South Carolina		4			6	6	9
Georgia		3			5	16	9
Florida		1				4	
East South Central	1	51		1	15	29	20
Kentucky		18			2	5	7
Tennessee		21		1	5	18	3
Alabama		12				5	4
Mississippi	1				8	1	6
West South Central		22		1	7	198	23
Arkansas		1		1	2	47	8
Louisiana		1			2	4	
Oklahoma		6			2	14	1
Texas		14			1	133	14
Mountain	5	12		6	7	41	
Montana		7				8	
Idaho		1				8	
Wyoming				2			
Colorado		2				2	
New Mexico					6	7	
Arizona		1			1	15	
Utah	5	1		4		1	
Nevada							
Pacific		80			7	75	1
Washington		7				7	
Oregon		10			1	3	
California		63			6	65	1
Alaska							
Hawaii		1					

[1] Includes cases reported as streptococcal sore throat.
[2] Includes cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Sept. 29, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	4						3		1		
Chickenpox	333	3		7	1	58	91	14	70	46	43
Diphtheria	6					4	2				
Dysentery, bacillary	70					5	3		57		5
German measles	53			4		18	4		4	14	9
Influenza	6			4				1	1		
Measles	321	26		33	1	54	46	24	7	53	77
Meningitis, meningococcal	11	2			1		3	4		1	
Mumps	185	5		1		28	78	10	8	28	27
Poliomyelitis	112			12	2	12	68	4	6	3	5
Scarlet fever	165			1	1	20	22	13	7	34	67
Tuberculosis (all forms)	212	9		4	31	88	12	21	13	4	30
Typhoid and paratyphoid fever	8					6	1				1
Venereal diseases:											
Gonorrhea	305	8		10	4	76	39	25	21	33	89
Syphilis	76	1		1	7	31	14	4	9	3	6
Primary	6					2		1	2	1	
Secondary	4					1			2	1	
Other	66	1		1	7	28	14	3	5	1	6
Whooping cough	173					56	46	6	36	22	7

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Cholera

Burma. During the week ended October 6, 1951, eight cases of cholera were reported in the seaport of Tavoy.

Pakistan. Two imported cases of cholera were reported in Chittagong for the week ended October 6, 1951. These are the first cases since the middle of August.

Smallpox

Bechuanaland. During the month of August 1951, 17 cases of smallpox were reported in Districts of Bechuanaland.

Egypt. One case of smallpox was reported for the week ended September 29. The last previous case was for the week ended March 3.

India. Smallpox was reported in ports of India for the week ended October 6, as follows: Trichinopoly, 3 cases; Bombay, 2; and Vizagapatam, 1.

Indonesia. For the week ended September 29, nine cases of smallpox were reported in Surabaya, Java. For the week ended September 22, two cases each were reported in Balik Papan and Bandjarmasin, Borneo.

Iraq. A sharp increase was noted in the incidence of smallpox for the week ended October 6, when 34 cases were reported as compared with only one for the previous week.

Sierra Leone. Three cases of smallpox were reported for the week ended September 1.

Typhus Fever

Libya. For the week ended September 29, 1951, three cases of typhus fever were reported in Tripolitania.

Turkey. One case each of typhus fever was reported in Istanbul and Izmir for the week ended October 6.

Yellow Fever

Costa Rica. During the period September 29–October 6, 1951, three deaths from jungle yellow fever were reported in Alajuela Province. From the beginning of the outbreak to September 26, about 70 cases with 34 deaths, have been reported. The outbreak began in Limon Province and spread to the jungle areas of the Provinces of Alajuela and Heredia.

French West Africa. One suspected case of yellow fever was reported on October 10, in Bembereke about 340 miles north of Catonon, Dahomey. Another case was reported on September 16 in Dahomey at Parakou.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The Public Health Reports, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON D. C. : 1951

**For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
Price 15 cents. Subscription price $4.75 a year. $6.25 foreign.**

Public Health Reports

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Housing Law Enforcement

By Ralph J. Johnson, M.S.[*]

Elimination of poor housing and production of good housing constitute one of the critical problems of the day. The Congress of the United States has declared "that the general welfare and security of the Nation and the health and living standards of its people . . . require a decent home and a suitable living environment for every American family" (*1*).

The Surgeon General of the Public Health Service has said that underlying every action to improve the quality of housing is the recognition that the home environment plays a significant role in determining the health status of the individual, the family, and the community, and "that in our efforts for higher levels of national health, an aggressive program for improving the quality of housing is a necessary adjunct to the provision of better health services" (*2*).

The housing problem does not tend to solve itself. Neither adequate new housing nor good used housing is within the economic means of all, so many persons live in substandard housing.

Recent surveys have shown that substandard housing exists in the small cities and rural areas as well as in the metropolitan communities (*3–5, 31–33*).

Speaking in terms of dwellings, the solution of the total housing problem requires threefold action: first, the rehabilitation of existing substandard housing where economically feasible, and the demolition of the extremely substandard dwelling that is beyond repair; second, production of sufficient new housing; and third, retardation of the rates of deterioration of dwellings and their environment (*6*).

This gigantic, complex task can be accomplished only through the combined effort of Federal, State, and local governments, private enterprise, and unofficial civic organizations, backed up by active citizen support. Cooperation among all the departments of local government concerned with the solution of the entire housing problem is particularly important. However, this report is concerned

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with only a part of that problem—the housing law enforcement activities of the health department (*7*).

Historical Development of Housing Regulations

The recorded history of regulations controlling housing begins with the Code of Hammurabi in Babylon about 4,000 years ago (*8*). This building code of a sort was simple and effective (*9*) but provided drastic penalties. If a builder constructed a dwelling that collapsed and killed the occupant, he was put to death. But that enforcement principle of an eye for an eye and a tooth for a tooth is hardly acceptable today.

Legislation regulating housing existed in China about 1000 B. C. and in Rome during the days of the Empire (*10*). The Roman Code of the Twelve Tables established minimum fire, structural, and sanitation restrictions and provided for fines and imprisonment for violators (*11*).

In 1189 A. D. the Assize of Buildings issued by the Lord Mayor of London required the use of stone party walls, cesspools, and a few other elementary safety and health requirements (*12*). However, preventive housing regulations did not appear until the seventeenth century (*13*).

The absolute genesis of housing regulations in this country is obscure, but certainly it occurred during the very early colonization period.

A complete documentation of the development of the history of restrictive housing legislation in this country is hardly possible here. The history of such progress for New York City is well recorded, however, and it undoubtedly furnishes for the most part the history of "housing firsts", so in this brief review we may advantageously confine our inquiries to that development.

In 1625 detailed instructions for the layout and construction of dwellings were given to the engineer and surveyor who planned the first settlement on what is now known as Manhattan Island (*14*). In 1647 surveyors were appointed, in what was then called the New Amsterdam Colony, to superintend houses and fences, and land owners were required to build on their land within 9 months of residence or forfeit it. This was a significant early recognition of the primacy of the community's interest in the land (*15*).

Shortly after the middle of the seventeenth century, the provisions for social control of housing through legislation and enforcement were developed under burgher government in New Amsterdam (*16*). The means for inspection of houses were enlarged and more drastic penalties were provided for violations.

Then in 1657 a new type of legislation appeared in New Amsterdam relating to sanitary disposal of "rubbish and filth" from dwellings (*17*).

Two decades later, in 1676, the minutes of the common council of New York City (*18*) recorded that "all the ruinated and decayed houses which are untenentable within this City, bee forwith viewed, apprized and valued . . .: And to be disposed off to those who are willing to build or repaire the same."

By the close of the seventeenth century this community of 5,000 people on Manhattan Island had developed devices for social control of housing that greatly influenced subsequent housing legislation. And so Ford (*19*) has stated, ". . . the power to inspect and the right of entry by public authority had been established. Tenants, as well as owners, had been subjected to special controls in their use of both house and premises; public health and safety had been protected by restrictive legislation with regard to sanitation and fire risks. Already there had been sporadic attempts to direct the use of land to general social advantage."

The first half of the eighteenth century was unproductive of housing legislation, but in 1761 new regulations were enacted for New York City and extensively revised in 1775. Significantly, these provided for improvements to buildings already constructed and marked perhaps the beginning of a modern period in housing legislation.

In 1797 three commissioners of health were appointed for New York City, and the law authorizing their appointment recognized that housing was one of their primary concerns (*20*).

In 1834 Gerritt Forbes, city health inspector of New York, made the first American reference on record (*21*) to the coexistence of high death rates and bad housing conditions. In 1842 Dr. John H. Griscom became city health inspector of New York. While serving in this job and as a result of his reports in 1844 and later (*22–24*), he distinguished himself as the first outstanding figure in American housing reform (*25*). At that early time the importance of health and safety improvements to existing housing was acknowledged. Thus, the relation between health and housing has been recognized for more than a century.

The Association for Improving the Condition of the Poor was founded partly as a result of Griscom's activities. As a result of extensive surveys conducted by the association and by others, the New York State Legislature passed the first tenement house law (*26*) for New York City in 1867. This was "the first exercise of the police power in this country to regulate the use of private property, as tenement houses, in the interest of the health, safety, and morals of tenants" (*27*).

Meanwhile other American cities—Boston, Philadelphia, Chicago and Washington—were becoming housing conscious and were making a beginning at investigation and regulation.

Then the 1895 report of the Tenement House Committee of New

York (*28*) led to the passage of the Tenement House Act of 1901 (*29*), perhaps the most significant document regulating housing in America's history. The principles and methods of this law still underlie much of our restrictive housing legislation.

During the next third of a century other cities and States enacted restrictive legislation patterned frequently after the New York Tenement House Law and Lawrence Veiller's Model Housing Law (*30*). There followed a wave of zoning regulations, and the movement for comprehensive city planning originated about 1916.

This takes us to the era of constructive housing legislation beginning with the National Recovery Act in 1932 and including such outstanding legislation as the Housing Act of 1937 and the Housing Act of 1949.

And so we see that restrictive housing regulations and their enforcement began some 4,000 years ago, were present in the days of the Roman Empire, began in this country some 300 years ago, and were developed to a fine degree as long as a half a century ago. We see also that during much of our Nation's history of housing reform, health regulations have been a fundamental basis for housing improvement and health officials have played a significant role.

Some Principles of Housing Law Enforcement

Education of the public regarding the housing conditions that exist in the community is the first requisite for a housing law-enforcement program. Ascher (*34*) points out that Justice Holmes in a decision stated "that the police power was whatever the community preponderantly desired at a given time." The well-recognized importance of the public press in this matter cannot be overemphasized. Dr. Huntington Williams, health officer of Baltimore, gives due credit to the influence of the Baltimore Evening Sun which, through its editorials and pictures, brought daily to the people of Baltimore the story of the slums of that city. He stated that this 2-year initial educational support was the essential foundation stone for Baltimore's later success in the housing law enforcement field (*35*).

The excellent series entitled, "Progress or Decay? St. Louis Must Choose" in the St. Louis Post-Dispatch, appearing in May 1950, is another noteworthy example of the important public education job that the press can do. Obviously, all the other educational techniques with which public health educators and public health specialists are familiar should also be used.

It is not enough, however, to make broad general statements and to propose general programs. Specific housing information must be obtained to state exact facts and, more importantly, to formulate a policy of action (*36–39*).

Fortunately, there exists an established technique for determining these housing facts. The Appraisal Method for Measuring the Quality of Housing (*40*) has now been used by more than 30 departments of local government (mostly health departments) and over 150,000 dwellings have been studied.[1]

Once the specific information has been obtained, standards and laws for enforcement can be formulated intelligently. Generally speaking, housing regulations from the public health viewpoint should include standards of health, safety, and amenity for new family dwellings of all kinds and their environment; standards of occupancy and maintenance for existing family dwellings; standards for such special dwellings as trailer camps, dormitories, and rooming houses; and the extension of suitable controls beyond the built-up areas (*41*).

Laws are not self-enforcing. Once they are established the actual accomplishments of enforcement stand or fall on the judgment, the efficiency, and the impartiality with which the laws are administered (*42*).

The responsibility for administering laws or regulations relating to housing should be centered. This can be accomplished by establishing a board consisting of the heads of the departments directly responsible for enforcement of housing regulations and one or two others who are vitally concerned. For example, a typical board might consist of the commissioners of the building, fire, and health departments along with the executive director of the Housing Authority or the slum clearance and redevelopment agency, and the head of the planning department. In some communities the commissioner of police and the director of welfare may be added to, or substituted for, one of the above representatives. This board should be responsible to the administrative head of the city. A new department need not be created (*43*, *44*).

It is so obvious that an adequate budget is necessary that even to mention it may seem gratuitous. This does not necessarily mean that additional funds must be appropriated to provide for all of the personnel. Although not well documented, numerous engineers in municipal public health work have reported that the instigation of a systematic housing inspection program reduces the number of complaints and thereby the inspectional load. This is obvious when consideration is given to the type of complaints received by health departments (*55*).

It is necessary to have competent personnel and to insure their continued interest and efficiency by such devices as in-service training

[1] Through an agreement between the American Public Health Association and the Public Health Service, training in the use of this method is available at the Public Health Service housing training stations at Atlanta, Ga , and Syracuse, N. Y. Follow-up assistance is also provided. No charge is made for the course, but the trainee must provide for his own subsistence and quarters.

programs and changes in their area of operation. Likewise a systematic scheme of keeping adequate records is essential.

"The regulation of housing is an application of the police power of the community to insist that an individual limit his freedom of action in the paramount interest of the community, without compensation," according to Ascher (*45*). It is beyond question that the legislatures, in the interest of public health, safety, and welfare may, either directly by statute or by authority conferred upon municipal corporations, enact rules and ordinances regulating the manner of constructing buildings and making alterations and improvements (*46–48*).

This power is not without limit. It must be exercised so as to have a reasonable relation to the nature of the problem to be corrected and the improvement to be effected. Further, police power and procedures of enforcement must not be used in an arbitrary or capricious manner that will put undue burdens on owners. There have been, comparatively speaking, only a few tests of this power. One of these [2] is a basic case, and in his opinion Judge Peckham declared, "Reasonable provision for the health and safety of the inhabitants . . . and the welfare of the community is the test" of the legal validity of such actions (*49*). The right of entry without a warrant to conduct a health inspection has recently been challenged, but the U. S. Supreme Court disposed of the case without passing on the ultimate constitutional issue (*50*).

It is the enlightened use of the police power that Ascher says we must look to for our base (*51*). He further states that the doctrine of nuisance is not a profitable basis for regulation of housing by health officials. Briefly, Parratt (*52*) accounts for this by pointing out that nuisances have been, for the most part, judicially defined. However, the advent of the germ theory of disease and later scientific developments establish the health official—not lawyers and judges—as the repository of a special expertness in matters pertaining to health and housing.

Certain administrative legal procedures must be adhered to if the purpose is to make the administrator's action conform with legal due process so as to minimize the possibility of administrative decisions being overruled by the courts.

These procedures are not identical in detail for all areas. Nor does authority for establishing them exist in all communities. However, the administrative officer must first develop a set of standards, recognizing well-established scientific criteria [3] for healthful housing within the realm of public support and understanding. Then he should make

[2] New York Health Department *v.* Trinity Church, 145 N. Y. 32 (1895).

[3] For example, the Basic Principles of Healthful Housing developed by the Committee on the Hygiene of Housing of the American Public Health Association.

a specific set of rules to guide enforcement that will make clear the standards to be imposed (*53*).

In the entire enforcement process, there must be a truly democratic effort by the administrator to balance coercion against education and persuasion. This process begins with the rule making. The persons to be affected should be given an opportunity to be heard, to present contrary evidence or opinion, and significantly to define for the administrator the level of community acceptance of the proposed regulations.

The statute should impose the obligation to hold a hearing before enforcement action is undertaken. This can be accomplished by notice of complaint and the setting of a hearing place and date (*54*). The interested party should then have the opportunity to present testimony in his behalf. Such action presumes of course that all typical efforts of the health department to obtain voluntary compliance have failed.

If the administrator, after making a finding of the facts, decides that a violation exists, he should then proceed with service of an order to abate or another indicated remedial action. All the proceedings should be recorded carefully. Court action is necessary in only a small proportion of cases. However, the administrative procedure should be carried out as though court action will be required in all cases.

In certain instances it may be advisable to establish the board, previously referred to, as an appeal body. In large cities the volume of housing and other enforcement cases may justify the appointment of a hearing officer representing this and perhaps other boards. All the appeal proceedings should be only quasi-judicial but should be duly recorded. If need for summary action exists, it may be necessary to eliminate the hearing procedure before taking enforcement action; however, subsequent opportunity for hearing should be afforded.

Study of the housing law enforcement problems of health officials leads one directly to the conclusion that adherence to good administrative legal practices is essential for effective results. The above is by no means a complete statement of this complex procedure. Obviously, health officials should consult lawyers expert in the field of administrative law before attempting large-scale housing law enforcement programs.

Current Housing Law Enforcement Activities

Since the end of World War II, there has been a resurgent interest and activity by health departments in the hygiene of housing. Specific information from a number of local health departments around

the country indicates that they are engaged extensively in public education and intensive surveys to obtain the facts. As a result of these studies, many cities have adopted new laws or regulations, or amendments to existing laws, or are proposing their adoption.

When considering improvement programs for substandard housing, the health official has always to keep in mind the deterrent factors of cost and poverty. Although extensive reports of improvement as a result of enforcement action are not available, it is known that important results are being obtained.

In Baltimore, for example, during a recent 2-year period, the health qualities of over 2,100 dwelling units were improved significantly. In Washington, D. C., the health qualities of approximately 500 dwellings were materially improved in a recent year along with numerous minor housing improvements—and this with only a small staff. Among others, the health departments of Milwaukee, St. Louis, Los Angeles, Memphis, Atlanta, Miami, Birmingham, and Brookline are engaged in significant programs to improve the quality of substandard dwellings.

Summary

Out of the above discussion come four points, which in effect, summarize the material. These are: First, there is a housing problem today, and health department enforcement of regulations pertaining to health can help to solve that problem; second, the interest and importance of the health official in the housing problem is by no means new; third, enforcement though not easy is possible by giving attention to public education, by fact finding, by adopting reasonable laws, and by administering the program soundly; and fourth, a few local health departments today are actively engaged in a program of housing improvement, and a score of others are well on their way to a genuine program of housing law enforcement. This bodes well for the future.

REFERENCES

(*1*) Housing Act of 1949. PL 171 (S. 1070), 81st Cong., 1st sess., ch. 338.

(*2*) Scheele, Leonard A.: [Testimony in] Hearings of a Subcommittee on Banking and Currency of the 81st Cong., 1st sess., Feb. 11, 1949, pp. 433–443.

(*3*) U. S. Bureau of the Census: Current population reports, housing—Housing characteristics of the United States, series P–70, No. 1, April 1947, 26 pp.

(*4*) U. S. Bureau of the Census: Current population reports, housing—Selected characteristics of occupied dwelling units and lodger quarters in the United States, series P–70, No. 3, May 1948, 10 pp.

(*5*) Dewhurst, J. Frederick, et al.: America's Needs and Resources. New York, Twentieth Century Fund, 1947.

(*6*) Johnson, Ralph J.: Housing, a public health problem. *In* Proceedings, Annual Meeting Southern Branch, American Public Health Association, 1950, pp. 32–34.

(*7*) Johnson, Ralph J.: The Housing Act of 1949 and health department programs. Pub. Health Rep. **64:** 1331 (1949).

(*8*) Thompson, Geo. N.: The problem of building code improvement. Law and Contemporary Problems **12:** 96 (Winter 1947).

(*9*) Harper, R. F.: The Code of Hammurabi. University of Chicago Press, 1934.

(10) Aldridge, Henry R.: The National Housing Manual. London, National Housing and Town Planning Council, 1923, pt. 1, pp. 37, 49.
(11) Burton, Frank: History of building and fire prevention codes. Quart. Nat. Fire Protect. Assoc. **23:** 364 (1930).
(12) McGoldrick, Joseph D., et al.: Building Regulation in New York City, New York, Commonwealth Fund, 1944.
(13) Ibid.
(14) Ford, James, et al.: Slums and Housing, Cambridge, Harvard University Press, 1936, vol. 1, p. 22.
(15) Ibid., p. 28.
(16) Ibid., p. 30.
(17) Ibid.
(18) Minutes of the Common Council of New York, 1675-1776, vol. 1, p. 14.
(19) Ford, op. cit., p. 39.
(20) Laws of the State of New York passed at the sessions of the legislature held in the years 1798, 1799, 1800, inclusive, pp. 14-16. From Ford, op. cit., p. 70.
(21) Wood, Edith E.: A century of the housing problems. Law and Contemporary Problems **1:** 138 (1934).
(22) Annual report of deaths in the city and county of New York, for the year 1834, pp. 15, 16. From Ford, op. cit., p. 96.
(23) Annual report of the interments in the city and county of New York, for the year 1842, with remarks thereon, and a brief view of the sanitary conditions of the city, presented to the Common Council by John H. Griscom, M.D., city inspector, pp. 161-188. From Ford, op. cit., p. 103.
(24) Griscom, John H.: The sanitary condition of the laboring population of New York. At the repository of the American Institute.
(25) Ford, op. cit., p. 102.
(26) New York Laws 1867, c. 908.
(27) Wood, op. cit., p. 138.
(28) Report of the Tenement House Committee of New York, 1895.
(29) New York Laws 1901, c. 334, 555.
(30) Veiller, Lawrence: A Model Tenement House Law. New York. Russell Sage Foundation, Charities Publication Committee, 1910.
(31) Atlanta Health Department: An appraisal of the quality of housing—District 1. Atlanta, Ga., 1949, 42 pp.
(32) Minneapolis Division of Public Health: Special Report. An appraisal of housing quality, first district. Minneapolis, Minn., 1949, 17 pp.
(33) Dade County Health Department, et al.: Dwelling conditions in two principal blighted areas. Miami, Fla., 1949, 68 pp.
(34) Ascher, Charles S.: Regulation of housing: Hints for health officers. Am. J. Pub. Health **37:** 507–514 (1937).
(35) Williams, Huntington, and Schulze, Wilmer H.: Housing law enforcement and the city health department's attack on slums. Baltimore Health News **25:** 2 (1948, Dec.)
(36) Graves, L. M., and Fletcher, A. H.: Problems of a housing enforcement program. Am. J. Pub. Health **28:** 695 (1938).
(37) Krumbiegel, E. R.: An appraisal method for housing conditions and needs. The Municipality **40:** 259 (1945).
(38) Veiller, Lawrence: Housing Reform. New York, Russell Sage Foundation, Charities Publication Committee, 1910.
(39) Pond, M. Allen: Need for systematic evaluation of substandard housing. Am. J. Pub. Health **37:** 967 (1947).
(40) American Public Health Association, Committee on the Hygiene of Housing: An Appraisal Method for Measuring the Quality of Housing. New York, The Association, 1945, 71 pp.
(41) The improvement of local housing regulation under the law. Am. J. Pub. Health **32:** 1263 (1942).
(42) Trull, Edna: The Administration of Regulatory Inspectional Services in American Cities. New York, Municipal Administration Service, No. 27, 1932, 184 pp.
(43) Veiller, Lawrence: Housing Reform. New York, Russell Sage Foundation, Charities Publication Committee, 1910.
(44) Roberts, S. M.: Housing Inspection and Rehabilitation Program for Kansas City, Mo. Kansas City, Department of Research and Information, 1950, 23 pp.

(*45*) Ascher, op. cit., p. 509.
(*46*) Dillon, John F.: Municipal Corporations. Boston, Little, Brown and Co., 1911, pp. 1069–72.
(*47*) North Eastern Reporter, vol. 18, N. E. (2d). St. Paul, Minn., West Publishing Co., 1939, pp. 153–156.
(*48*) American Law Reports. Rochester, N. Y., the Lawyers Co-operative Publishing Co., 1937, vol. 109, pp. 1117–20.
(*49*) Dillon, op. cit., p. 1072.
(*50*) District of Columbia *v.* Little. 339 U. S. 1 (1950).
(*51*) Ascher, op. cit., p. 507.
(*52*) Parratt, Spencer: Administrative-legal methodologies in elimination of substandard housing. Law and Contemporary Problems **12:** 111 (Winter, 1947).
(*53*) Ascher, op. cit., p. 510.
(*54*) Rhyne, Charles S.: Demolition, Vacation, or Repair of Substandard Buildings. Washington, D. C., National Institute of Municipal Law Officers, Report No. 111, appendix D, 1945, p. 76.
(*55*) Pond, M. Allen: Nuisance complaints and municipal health department practices. Pub. Health Rep. **60:** 381 (1945).

Public Health Consideration on Housing Design and Home Accident Prevention

By FREDERICK S. KENT and M. ALLEN POND*

With an improved housing environment, would the home accident rate decrease?

An attempt to answer this question was made in 1940 in a survey of a New England housing project. Prior to that the National Health Survey, a pioneer study conducted in 1936 to evaluate the Nation's health status, concluded that home accidents gained in frequency as rents or values of dwelling units and family incomes declined. Apart from social, psychological, and income factors affecting home accidents, however, the question still remains whether an increase in expenditures for housing automatically eliminates structural ha'ards.

The New England survey studied 1,000 families living in a public housing project to determine what changes occur in frequencies and types of accidents when families move out of delapidated housing into new structures. The families were asked to report on home accidents that had occurred in the 2 years before they moved and in the 2-year occupancy in the housing project. Obviously, recollections fade in proportion to time lapse. Furthermore, the strangeness of the new environment in this case was an indeterminable cause of accidents. These factors help to account for the fact that the frequencies of reported accidents were not materially changed.

In the housing project, accidents on stairs were only two-thirds of the former number; only one-half as many burns due to contact with steam pipes and radiators and approximately one-fourth the number of burns from stoves were reported. In their former housing, a significant number of accidents resulted from rotten and loose boards, splinters in the floor, leaking gas, faulty electric fixtures, and stuck windows. In the new homes such accidents were not reported. Instead, accidents were caused by kitchen cabinet doors, nails or pins pushed into electric wall plugs, glass in entrance doors, and incinerators: all elements new to the occupants' experience. It appears that in efforts to improve environment we often substitute new hazards for old.

A similar study is being planned in another eastern city. To re-

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duce the error of recollection, families who have applied for admission to a public housing project scheduled for completion late in 1952 will be interviewed regularly during the next 2 years on accidents occurring in their present domiciles and then will be interviewed periodically for 2 years at the housing project.

New private homes do not afford complete protection from accident potential any more than does low-cost public housing. To illustrate, we will recount a tragic accident. A 31-year-old housewife, her husband and 3-month-old baby had moved into a new home that represented the climax of years of hope and plans. For 10 months before moving they had lived on the third floor of a walk-up apartment house. During that time there was no noteworthy accident. However, 3 days after moving into her own new home, the housewife died from a fall down the cellar stairs. It was late afternoon, dark enough for a light, as she went down the hallway to the kitchen, intending to make coffee. But no light switch was at hand in the hall. She opened what she believed was the kitchen door. It was actually the cellar doorway she stepped through. Her husband suggested five factors that contributed to the accident: (1) unfamiliarity with the surroundings, (2) lack of light switch at both ends of the hallway, (3) absence of a landing at the top of the cellar steps, (4) absence of a handrail on those stairs, and (5) failure to provide an automatic light switch on cellar stairs controlled by opening the door. Any one of these installations might have saved her life, and the additional expense in this $25,000 home would have been insignificant.

Home accidents are a major source of unnecessary and untimely deaths and disabling injuries. And yet we are doing little to build safety measures into our homes. Even with the limitations imposed on housing by the emergency, we are proceeding with extensive building projects. Every house built will be in use for at least a third of a century. Thus, any accident hazards that happen to be built into the house will (unless later removed) provide exposure to the occupant for many years. It is well known that deterioration of dwellings begins early and increases with time. Hence, the likelihood that built-in hazards will be subsequently eliminated is relatively slight unless there is aggressive enforcement of local housing regulations. If we were to design each house so that it will be safe, so that all unnecessary accident hazards are eliminated, we could materially reduce our annual accident toll.

Such a task is by no means simple. It requires the assistance of each individual householder in addition to all the local, State, and Federal agencies and organizations, official and voluntary, that are concerned.

To base a housing safety program on a sound foundation, we may borrow the three E's from other safety fields—engineering, education,

and enforcement. We place engineering first since it is our conviction that it is the most tangible and most readily affected area of work. Providing safe housing and equipment to insure safe living should be the goal of the engineer, architect, contractor, and builder. They should plan not only to reduce hazards but also to reduce stresses and strains, to lessen cardiac and muscular fatigue. A home that provides compactness and an efficient lay-out, preferably a single-story dwelling, reduces accident hazards and the strain on the heart, if only by eliminating the use of stairs.

Education is to be associated with any effective prevention program. We must educate the individual to be aware of and to recognize accident hazards, to practice rules of safe living, and to assume a healthful attitude toward danger. There can be no "accident-proof" home as long as people are unaware of, or indifferent to, all safety considerations. Often economics comes into conflict with education. In one public housing project, an architect was asked to remove from his design three-way switches controlling the overhead lights in passageways. The saving was $13 for each switch. This request disregarded the fact that it created a 15-foot unlighted walk to the pull-chain along a passageway customarily littered with children's toys. Thus, at a saving of $13 per apartment, the builder exposed each of his tenants daily to a reducible hazard.

A similar situation involved installation of handrails around the platform of the outside stairways of a group of private homes near Washington, D. C. The building code requires that when such a platform is 30 inches above the ground or higher, there shall be a protective railing. The contractor, to save the cost of the rails, built the platforms 29½ inches above the ground. Luckily, the owner of the subdivision was less interested in cost and more interested in eliminating hazards. The handrails were installed as soon as the matter was brought to his attention.

Thus, we approach our last E— enforcement or, to be exact, legislation. Building codes have long included structural requirements to prevent collapse of structures and to some degree prevent accidents to occupants. Adequate enforcement of building codes must be practical. Along with this, we need the establishment and determined enforcement of housing codes to reduce accident hazards. Whereas building codes are applied to new construction but not again until a permit for remodeling or major building alteration is requested, housing codes are enforced routinely for the life of the dwelling. Health departments can thus not only determine violations of basic health and sanitation needs but of safety requirements as well.

The Committee on the Hygiene of Housing of the American Public Health Association has devised a valid quantitative method for measuring the quality of urban housing. In formulating the basic

health needs for housing, the Committee included 30 basic principles. Seven of the 30 were grouped under the heading: Protection Against Accidents. These seven principles, listed as 24 to 30, are:

1. Erection of the dwelling with such materials and methods of construction as to minimize danger of accidents due to collapse of any part of structure.
2. Control of conditions likely to cause fires or to promote their spread.
3. Provision of adequate facilities for escape in case of fire.
4. Protection against danger of electrical shocks and burns.
5. Protection against gas poisonings.
6. Protection against falls and other mechanical injuries in the home.
7. Protection of the neighborhood against the hazards of automobile traffic.

Home accidents are one of the more tangible aspects of the general problem in the relation of housing to health. They can measure the direct relationship between certain characteristic structural conditions or lay-outs in housing and the accidents that are caused thereby. The appraisal technique is a clear-cut method of measuring objectively the quality of housing. Additional information on home accident hazards can be obtained by expanding the appraisal schedule so that it will pick up details which are not otherwise gathered in the ordinary housing survey. A study is being planned to reveal the prevalence of specific accident hazards in the average home and to determine which of these hazards are most often involved in accidents. Currently a list of 110 potential accident hazards has been compiled. However, if we can reduce this number to the 20 or 30 most important ones, we will have a more practical working list.

From past experience in the health field, it is evident that persons can be motivated to correct a few defects, but a large number of defects present an undertaking that overwhelms them.

The Committee has published three guides to healthful housing—Planning the Neighborhood, Planning the Home for Occupancy, and Construction and Equipment of the Home.

The Committee's general statement on safety in the second volume is detailed in the third. The general statement emphasizes the safety value of space—to permit easy movement about the home, to put away toys and other objects which may cause falls, and to keep safely out of reach the things that are not to be trusted to the hands of curious small boys and girls. Adequate lighting is recommended for all parts of the dwelling, including storage closets. There are also specific precautions on windows, such as a sill at least 30 inches above the floor; designs for stairways and balconies; fire protection; and adequate clearances in front of stoves and other equipment that may cause burns. The first volume discusses measures against traffic hazards on the site.

The Committee is interested in setting up housing codes as companions to building codes and the establishment of administrative

techniques for enforcing housing codes. Such measures take into account not only the sanitary short-comings of existing housing but also other kinds of hazards of which accident hazards are a significant group. This activity is being carried on in cooperation with the National Safety Council and the Public Health Service.

The Committee represents a group of experts in the various aspects of the housing field and of the health field. One member is an expert in home safety. Through its activities the Committee is influencing not only health people, but also housing officials, redevelopment officials, code writers, enforcement officials, and many others closely allied with public health.

We shall cease to add annually to our large number of hazardous homes on the day when safety will be demanded by all—by the architect, the builder, the government official, and most importantly, the householder. Possibly that will be the day when classified ads of homes for sale will print leads in large type reading not only "High on a Hill" or "Old World Charm," but also will include a line to the effect that "This is a Safe Home."

Plague on the High Seas

By Vernon B. Link, M.D., M.P.H.*

Plague has been spread along trade routes ever since the beginning of commerce. Dissemination of this disease was relatively slow when overland routes were the principal means of transportation. With the development of ocean travel, the speed of dissemination was proportionately increased. For many centuries ships continued to carry plague back and forth across the high seas. Today, however, seagoing vessels are practically free of rats, and the danger of their transporting plague has been nearly eliminated. The story of how this occurred is an interesting chapter in world history. The part played by the Public Health Service constitutes one of the most valuable contributions to plague prevention which has ever been made by any organization.

The first official recognition of the danger of importing plague from across the seas was recorded in 1127 at Venice, Italy. Every traveler from the Levant was required to remain in the house of St. Lazarus for 40 days before being admitted to the city. After the Black Death of 1346 to 1355, overseers of public health (proveditori sopra la saluti della terra) were appointed in Venice to isolate vessels, persons, and goods suspected of carrying infection. In 1403, a maritime quarantine station was established; and in 1448, quarantine regulations were formulated on which all later measures have been based (*1*).

Over eight centuries elapsed between the time when the Venetians first attempted to halt the spread of plague by quarantine measures and the period when ships practically ceased to be carriers of the disease. During these 811 years (1127 to 1938), quarantine measures must have had some deterrent effect on the spread of plague. However, the actual results were unimportant because efforts were directed primarily at the detection and isolation of human plague.

Simply because the epidemiology of plague was not understood, no cognizance was taken of the much greater importance of the rat and flea as host and vector of the disease. As a result, rodent plague continued to be spread widely in spite of the fact that the occasional resulting human cases were carefully isolated by quarantine procedures.

It is astonishing that the importance of the rat and its flea was not

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recognized until the twentieth century. Numerous clues have been recorded in all kinds of literature which long ago should have led someone to suspect that rodents were the important links in the infection chain. The Bible contains a reference to the association between mice and a plague outbreak among Canaanites (*2*). Poseidonius at the beginning of the Christian era stated, "One can see an approaching plague by paying attention to the ill conditions of the seasons, to the mode of living less conducive to health, and to the death of animals that precede its invasion." In the eighteenth century, a Chinese named Shih Taonan (1765 to 1792) wrote a poem which pointed out the relationship of rodents to human plague (*1*).

"Dead rats in the east,
Dead rats in the west!
Few days following the death of the rats,
Men pass away like falling walls!"

In the Hong Kong epidemic of 1894, the Chinese must have been aware of the connection between mortality in rats and plague in man, because one official offered a reward of a 10-cash piece for every dead rat brought to him. In a short time, 35 thousand were paid for, and a Dr. Rennie dissected many of them. He found enlarged glands in 90 percent and asked, "Is the disease in man and animals identical?" In the same year, however, J. A. Lowson (*1*) in the official report of the Hong Kong outbreak wrote, "The question of the infection of rats previous to the epidemic being noted in human beings has been made too much of."

Ogata, working in the Formosa epidemic in 1897, stated that the disease was known there as "rat-pest" (*3*). Simond, in 1898, noted the frequency of disease among those who had recently handled rats (*4*). Thompson, in 1900, expressed his opinion that rats played the chief part in spread of the disease (*5*). Finally, the Commission for the Investigation of Plague in India, working from 1906 to 1917, proved conclusively that rats and fleas were the hosts and vectors of the disease (*6*). This brilliant sequence of epidemiological research demolished previous theories that plague was spread by cadaveric poison, foamites, soil, or flying insects, and established at once and for all time that the disease was primarily one of rodents, with man becoming involved secondarily.

In the meantime, another pandemic of plague had become well established and there was accumulating a remarkable record of ship-borne plague. This pandemic is believed to have originated in the Chinese Province of Yunnan in 1893. At the end of February 1894, it had traveled overland to Pakhoi and Canton. A considerable epidemic occurred in Canton in March and April, and when it was at its worst, thousands of natives fled to Hong Kong. The reporting of

plague deaths on board vessels plying between Canton and Hong Kong was an almost daily occurrence. Hong Kong suffered from a serious epidemic starting in May 1894. Here again, when the situation became grave, an exodus to Canton took place which set up a vicious cycle keeping the epidemic going in both cities. In following years, the disease spread fairly rapidly to every continent and to nearly every country in the world. This dissemination could have been brought about only by overseas shipping, and the records of human and rodent plague on board ships in the period from 1894 to 1938 support this contention.

The first recorded instances of ship-borne plague in the present pandemic were plague cases occurring in June 1894 on two ships en route from Hong Kong to Japan and Singapore. No ship-borne plague was reported in 1895, but during the period from 1896 to 1938, plague was reported every year on board ships. There were 332 instances in which human, rodent, or both types of plague were confirmed by clinical or laboratory determinations. Of these, 291 were human cases only, 29 rodent plague only, and 12 were both types. One ship reported human cases 4 times in an 11-year period, 4 ships reported human cases on 3 occasions, 12 ships reported human plague twice, while 315 reported plague on board once only. These 332 instances involved many ports of departure and arrival in 55 different countries in all continents. The peak of ship-borne plague occurred in 1901 when 29 ships were reported with plague on board; 1 with rodent plague, 4 with rodent and human plague, and 24 with human plague only. Although the rat was not incriminated until 1906, there were 9 occasions in 1900, 1901, and 1904 when infected rats were found on board ships. That more were not discovered is undoubtedly due to the fact that a more intensive search was not made in those early days (*7*).

The existence today of plague-free world shipping has been brought about by a combination of several factors. Among the most important are: the succession of international agreements concerning the "quarantinable diseases" (cholera, plague, smallpox, typhus, yellow fever); the initiation and improvement of antirat fumigation of ships; the perfection of intensive rat infestation inspection methods; and the development and installation of ship ratproofing methods.

A long series of international meetings have been called to discuss ways and means of combating the spread of epidemic diseases among countries. These international agreements were responsible for developing the rules and regulations which govern modern maritime quarantine procedures. They have played an important part in the achievement of a plague-free world shipping (*8*).

Agreement	Locality	Year signed
International Sanitary Convention	Paris	1903
Pan American Sanitary Convention	Washington	1905
International Sanitary Convention	Paris	1912
Pan American Sanitary Code	Habana	1924
International Sanitary Convention	Paris	[1] 1926
International Sanitary Convention	The Hague	[2] 1933
International Sanitary Convention	Paris	1938
International Sanitary Convention	Washington	[3, 4] 1944

[1] Modified by the International Agreement of 1934.
[2] Concerning aerial navigation.
[3] Including aerial navigation.
[4] Prolonged by the Protocol of 1946.

Fumigation of ships to destroy rats was started early in the present century. In this country, the first of such fumigations were performed at Savannah and at Tampa in 1903 (*9*). Routine fumigation alone, with the methods employed in the early days, could never have eradicated rats on ships. This is readily apparent from the records of the S. S. *Innamincka* in Australia, which was fumigated with sulphur:

Date	Port	Procedure	Rats obtained	Plague rats
5/21/07	Sydney	Trapping	19	1.
5/24/07	Melbourne	Inspection	164	Several.
5/25/07	Melbourne	Fumigation	164	Several.
5/29/07	Sydney	Trapping	63	None.
5/30/07	Sydney	Fumigation	69	None.
5/31/07	Sydney	Fumigation	509	None.
6/1/07	Sydney	Fumigation	70	None.
		Total	1, 058	

The fumigations on May 30 and 31 were done after completely unloading all cargo. When rats were still heard running around, the coal bunkers were unloaded and another 70 rats were obtained after the fumigation on June 1. Few ships before had ever been subjected to as thorough an effort to get rid of rats (*10*).

The above example is cited not to condemn fumigation as a rat-control measure, but to point out the relative inefficiency of the earlier methods. Modern fumigation techniques by first dosing the harborages with hydrogen cyanide and then gassing the main compartments will generally give a 100-percent kill. The use of hydrocyanic acid gas was first authorized by the Public Health Service in 1910, although its extensive use in this country did not come about until 1914 during the plague epidemic in New Orleans (*11*). Today, cyanide products are generally accepted as the most efficient antirat fumigants and deserve much credit in the campaign to rid ocean-going vessels of rodent infestations.

In the early years of this century, fumigations were prescribed at regular intervals which were arbitrarily established. The only criterion for fumigating a ship was the time elapsed since the previous fumigation. Obviously, this penalized a ship that had little or no rat infestation and really did not need to be fumigated. It erred in

regard to heavily infested ships which actually should have been refumigated before the expiration of the required interval. In an effort to put fumigation on a more rational basis, ships were inspected in order to determine the degree of rat infestation. This practice was started in Seattle in 1908 (*11a*). However, it was not until 1913 that general attention in this country turned to the degree of rat infestation rather than merely to the latest date of fumigation (*11b*). The art of ship inspection was subsequently developed to the point at which an experienced person could determine accurately the total number of rats present. It finally became accepted international practice to fumigate ships on the basis of the inspection result rather than on the duration of time since the last previous fumigation, and standards were prescribed which allowed maximum numbers of rats in relation to the ship's tonnage under certain conditions. The development of intensive rat infestation inspection services really put ship fumigation on a logical and sound basis.

Although international agreements, fumigation, and inspection methods have been important, the real story of the creation of rat- and plague-free shipping is the account of the development of ratproofing of ships. The earliest attempts were made by Grubbs and Holsendorf, Public Health Service Officers in Puerto Rico in 1912. They developed a system called partial ratproofing. This system consisted of removal, before fumigation, of dunnage, planking, casing, and other material which could give protection to rats from the fumigant gas or keep the gas from circulating properly. As a result, steamship companies began to make certain removable panels, which could easily be taken out or opened on hinges, for the places which fumigating crews had previously damaged by opening (*10*). Then in 1924, studies were initiated by the Public Health Service in New York on the complete ratproofing of ships. It was considered that while fumigation and trapping of vessels would continue to be valuable methods, ratproofing should take its place among antiplague procedures on ships in a manner similar to its use in buildings (*11c*).

Within a year, ratproofing methods had been developed to the point of practicability. By midyear 1925, 13 vessels were being ratproofed by Public Health Service personnel in New York harbor. This work was requested by steamship companies on a voluntary basis. They were quick to realize the advantages in economic savings as well as in subsequent saving of time by avoiding some of the compulsory fumigations (*11d*). In another year, ratproofing of ships began in Southampton, Bremen, Danzig, Buenos Aires, Gothenburg, and Bergen. Steamship companies began to employ regular ratproofing crews, and before long, ratproofing was being incorporated into all vessels under construction (*11e*). By 1929, standard specifications for ratproofing of ships had been approved by the American

Marine Standards Committee of the Department of Commerce (*11f*). In 1931, 75 percent of the better-class ships coming into New York had been ratproofed. Ratproofing had been completed on 288 vessels belonging to 47 different companies of 14 nations (*11g*). Ratproofing of ships in the United States received a big impetus during World War II when the Maritime Commission specified that Liberty and Victory ships be constructed in accordance with the Public Health Service specifications for ratproofing (*8*).

Ratproofing of ships has been a truly international effort. Its efficacy is shown not only by the fact that no plague has been reported on board any ship in the world since 1938, but also by the evidence that there was a decided decrease in rat populations as soon as a considerable proportion of ships were ratproofed. In a 7-month period between July 1, 1936 and January 31, 1937, there were 4,418 ship entries at our Atlantic ports. Of these, only 8.4 percent were found infested with rats. This compared very favorably with the figure of 50 percent infestation observed on ships at New York in the period between 1925 and 1927. This remarkable situation was credited at that time to effective fumigation, ratproofing of vessels, international certification, and intensive rat-infestation inspection (*12*). Although the end result could not have been accomplished without the operation of all four factors, it is significant that the big decrease in rat infestation did not occur until ratproofing of ships on a world-wide basis was well under way.

In April 1937, PUBLIC HEALTH REPORTS carried a statement that the Public Health Service "believes that the problem of overseas transmission of bubonic plague is almost solved" (*12*). The same article emphasized that precautions should not be relaxed and that there was need for the continuation and even intensification of the methods which have brought about the favorable conditions.

The 13 years which have elapsed since the above statement was made have supported the prediction that the problem of overseas transmission of bubonic plague was almost solved. One instance alone has been reported since then, when plague was found on board the S. S. *Ville de Tamative* in April 1938, at Beirut (*13*). Even World War II has not marred this record, which is somewhat surprising in view of the past association of war and plague.

For the first time since the beginning of ocean travel, the world is free of ship-borne plague; and it is almost inconceivable that any considerable amount of future spread by sea should occur, provided that we continue to maintain ships free from rats.

REFERENCES

(*1*) Scott, H. H.: A History of Tropical Medicine. Williams and Wilkins, Baltimore, 1939.
(*2*) The Bible, I Samuel 5 and 6.

(*3*) Ogata, M.: Ueber die Pestepidemie in Formosa. Zentralblatt f. Bakt. 1 Abt. **21:** 769 (1897).
(*4*) Simond, P. L.: La propagation de la peste. Ann. Inst. Pasteur **12:** 625 (1898).
(*5*) Thompson, Ashburton: Report on an Outbreak of Plague at Sydney, 1900.
(*6*) Reports on Plague Investigations in India. Plague Numbers and Supplements of the Journal of Hygiene, 1906 to 1917.
(*7*) PUBLIC HEALTH REPORTS, vols. 9 to 53 (1894 to 1938).
(*8*) Communication from the Division of Foreign Quarantine, Public Health Service.
(*9*) U. S. Public Health and Marine Hospital Service Annual Report. U. S. Government Printing Office, Washington, 1903.
(*10*) Grubbs, S. B., and Holsendorf, B. E.: Fumigation of vessels for the destruction of rats. Pub. Health Rep. **28:** 1266 (1913).
(*11*) Public Health Service Annual Report. U. S. Government Printing Office, 1915. (*a*) 1908; (*b*) 1913; (*c*) 1924; (*d*) 1925; (*e*) 1926; (*f*) 1929; (*g*) 1931.
(*12*) Overseas transmission of bubonic plague. Pub. Health Rep. **52:** 412 (1937).
(*13*) Foreign and Insular reports. Pub. Health Rep. **53:** 792 (1938).

Q Fever in California

IV. Occurrence of *Coxiella burnetii* in the Placenta of Naturally Infected Sheep

By Hartwell H. Welsh, M.S.,* Edwin H. Lennette, M.D., Ph.D.,* Francis R. Abinanti, D.V.M.,† and John F. Winn, D.V.M.†

Epidemiologic studies of Q fever in northern California have shown that approximately two-thirds of the human cases give a history of contact with livestock (*1*, *2*). Serologic surveys of the domestic livestock populations of presumably endemic and nonendemic areas in this part of the State have shown that antibodies to *Coxiella burnetii* are much more prevalent in sheep and goats than in cattle (*3*, *4*). These findings, among others, led to studies on the role of sheep in the epidemiology of the disease. The observation that the rickettsia is present in the milk of this species has already been reported (*3*) (see also Caminopetros (*5*) and Jellison et al. (*6*)). The presence of rickettsiae in the milk suggested that the organism may be present in other secretions or excreta. This report deals with the presence of *C. burnetii* in the placenta of parturient animals.

Material and Methods

Study Area

Eight sheep ranches in the Yolo-Solano County endemic area were selected. These ranches were chosen because previous serologic surveys had shown the presence of infection in the flocks, and human cases of Q fever had occurred on certain of the premises. The ranches were not contiguous.

Collection and Handling of Tissues

Placentas were collected from 72 animals of the 350 under observation, the animals being taken consecutively on each ranch as the lambs were born. The placental tissues were taken from the vaginal vault, or as they were being expelled. Only freshly delivered tissues were utilized; those expelled at times when personnel were not in attendance were not collected. Small portions of placental tissue were excised at random with sterile instruments, placed in sterile 30-ml. screw-cap jars, and immediately frozen on dry ice. The speci-

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mens were kept on dry ice until delivered to the laboratory, where they were subsequently stored at −20° C. in a mechanical refrigerator.

Preparation and Inoculation of Material

The frozen specimens were thawed under running, cold tap water. Each specimen was then washed three times with sterile 0.85-percent salt solution. A small portion of tissue, usually about 1 gm., was cut off, weighed, and ground into a 10-percent suspension in sterile skimmed milk. This suspension was centrifuged at 500 rpm for 5 minutes in a horizontal centrifuge. The supernatant fluid was drawn off, and sufficient penicillin was added to give a concentration of 200 units per ml. The suspension was incubated for 4 hours at 4° C., and then inoculated into test animals; guinea pigs, hamsters, or both, were used. When guinea pigs were employed, the material was inoculated into two animals, each receiving 2 ml. intra-abdominally; when hamsters were used, four animals were inoculated, each with 1 ml. intra-abdominally.

The test animals were kept under observation for 6 weeks, and then bled. The sera were examined for the presence of complement-fixing antibodies to *C. burnetii*. On the basis of experience in this laboratory, a 3+ fixation at a dilution of 1:32, or greater, by the sera of one or more animals of the test group was interpreted as definite evidence of infection, and hence that the rickettsia was present in the placental tissue under examination.

Uninoculated animals were held under the same conditions in the same quarters as the test animals as a control on the possible occurrence of cross-infection; none of the control animals, held in cages interspersed with those containing the test animals, developed complement-fixing antibodies.

Complement Fixation Tests

These were conducted according to the method previously described (*3*). The Henzerling (Italian) strain of *C. burnetii* was used as the antigen.

Results

A total of 72 ovine placentas was tested, and 21 (or 29 percent) were found to contain *C. burnetii* (table 1).

Forty-seven placentas were tested by guinea pig inoculation, and subsequently the same suspensions were tested in hamsters as a check; in 42 instances, the results of tests in both species were in agreement. Thus, 36 placentas were negative and 6 were positive by both tests. In the remaining 5 instances, placental suspensions were negative by guinea pig inoculation, but were positive when tested in hamsters.

Twenty-five placentas were tested by inoculation into only one or

Table 1. *Presence of* Coxiella burnetii *in placentas of parturient sheep from an endemic area in northern California*

Ranch	All sheep			Serologically positive sheep			Serologically negative sheep		
	Placentas tested	Placentas positive	Percent positive	Placentas tested	Placentas positive	Percent positive	Placentas tested	Placentas positive	Percent positive
1	11	5	*45*	7	3	*43*	4	2	*50*
2	9	7	*78*	5	4	*80*	4	3	*75*
3	8	4	*50*	5	3	*60*	3	1	*33*
4	3	0	*0*	2	0	*0*	1	0	*0*
5	13	2	*15*	7	2	*29*	6	0	*0*
6	17	0	*0*	8	0	*0*	9	0	*0*
7	2	1	*50*	2	1	*50*	0	0	*0*
8	9	2	*22*	7	2	*29*	2	0	*0*
	72	21	*29*	43	15	*35*	29	6	*21*

the other test species. Of 16 tested in guinea pigs only, 7 were positive, and of 9 tested in hamsters only, 3 were positive.

Of the 72 placentas tested, therefore, 16 were found to contain *C. burnetii* on the first test, and 5 additional positives were found when materials negative by the guinea pig test were reexamined in hamsters.[1]

As is indicated in table 1, 43 placentas came from sheep which were serologically positive[2] for Q fever; 15 (or 35 percent) of these placentas contained the rickettsia. These findings are in agreement with those reported by Luoto and Huebner (7) for dairy cattle.

Of greater interest, perhaps, are the placentas which came from serologically negative sheep; of 29 specimens tested, 6 (or 21 percent) were found to contain *C. burnetii*. A similar situation has not been observed in dairy cattle (7).

To obtain some idea of the infectivity of placental tissue, portions of placentas from 6 sheep were titrated in guinea pigs or hamsters, or in both species; the results are presented in table 2. In general, the results of the few specimens tested indicate that the placentas of the serologically negative sheep contained from 100 to 10,000 hamster-infective doses per gram, and that the placentas of serologically positive sheep contained from 10 to more than 1 billion hamster-infective doses per gram. Additional information, however, is necessary to determine what the usual level of infectivity of ovine placental tissues might be.

Discussion

The finding of *C. burnetii* in the placenta of 21 of 72 sheep (29 percent) points to this organ as an important means of exitus for the

[1] Nine attempts were made to establish strains of *C. burnetii* from placental tissues by passage through guinea pigs; all nine were successful. Seven of the strains were isolated from the placentas of serologically positive animals, and two from the placentas of serologically negative animals.

[2] The term "serologically positive" refers to the presence of complement-fixing antibody (3+ or greater fixation at 1 : 8 or more (*3*)) in the serum at, or subsequent to, parturition, or in the colostrum at parturition.

Table 2. *Results of titrations of ovine placental tissues for content of* Coxiella burnetii

Sheep number	Antibody titer		Test species*	Dilution of placental tissue in skimmed milk							Hamster-infective doses (approximate) per gram placental tissue
	Serum	Colostrum		10^{-1}	10^{-2}	10^{-4}	10^{-6}	10^{-7}	10^{-8}	10^{-9}	
W1	<1:8	<1:8	Hamster	++++	+000	0000	0000	0000	0000	0000	10^2.
W7	<1:8	<1:8	Hamster	++++	++++	0000	0000	0000	0000	0000	10^3.
W39	<1:8	<1:8	Hamster	+++0	++++	+000	0000	0000	0000	00DD	10^4.
			Guinea pig	+D	++	00	00	00	00	00	
W4	1:64	<1:8	Hamster	++++	++++	++++	0000	0000	0000	0000	10^5.
W31	1:32	1:64	Hamster	+++D	0000	0000	0000	0000	0000	0000	10^1.
			Guinea pig	+0	00	00	00	00	00	00	
W38	1:64	1:128	Hamster	+++D	++++	++++	++++	++++	++++	++++	10^9 or >.
			Guinea pig	++	+D	00	++	++	0D	++	

*=4 hamsters, or 2 guinea pigs, used per dilution.
+=Serum of test animal positive (3+ or better fixation at serum dilution of 1:32 or more): animals bled 6 weeks after inoculation.
0=Test animal serum negative.
D=Test animal died.

rickettsia from the body of the infected animal. Also, the high concentration of rickettsiae in the placentas, as suggested by the preliminary titrations reported here, indicates that this organ constitutes a rich source of infective material for contamination of the environment.

Lambing in northern California takes place during the winter and early spring months only, customarily within lambing sheds or circumscribed pasturage. It is, therefore, presumably possible to attain a high degree of contamination in a relatively small area during certain times of the year. Such a set of environmental conditions agrees well with epidemiologic observations of the human disease made by Clark, Lennette, and Romer (*2*), viz, the incidence of human infection is seasonal, and is greatest among males of the working-age group.

An additional point of comment, and of some import in the epidemiology and epizootiology of the disease, is the finding that the rickettsia may be present in the placental tissues not only of serologically positive animals, put also in the placental tissues of serologically negative animals. Negative serologic tests in sheep should not, therefore, be interpreted as unequivocally excluding the existence of infection with *C. burnetii.*

Summary

The placental tissues of 72 sheep, representing both serologically positive and serologically negative animals from an endemic Q fever area in northern California, were examined for the presence of *Coxiella burnetii.* The rickettsia was found with relative ease and with about the same frequency in both serologically positive and serologically negative animals.

The significance of these findings is briefly discussed.

REFERENCES

(*1*) Lennette, E. H., and Clark, W. H.: Observations on the epidemiology of Q fever in northern California. J. A. M. A. **145:** 306–309 (1951).
(*2*) Clark, W. H., Lennette, E. H., and Romer, M. S.: Q fever in California. XI. Epidemiological summary of 350 human cases occurring in northern California in 1948–1949. (To be published.)
(*3*) Lennette, E. H., Clark, W. H., and Dean, B. H.: Sheep and goats in the epidemiology of Q fever in northern California. Am. J. Trop. Med. **29:** 527–541 (1949).
(*4*) Lennette, E. H., Dean, B. H., Abinanti, F. R.: Clark, W. H., Winn, J. F., and Holmes, M. A., Q fever in California. V. Serologic survey of sheep, goats, and cattle in three epidemiologic categories, from several geographic areas. Am. J. Hyg. **54:** 1–14 (1951).
(*5*) Caminopetros, J.: Le lait source de l'infection pour l'homme et les animaux. Ann. de Parasitol. **23:** 107–118 (1948).
(*6*) Jellison, W. L.; Welsh, H. H., Elson, B. E., and Huebner, R. J.: Q fever studies in southern California. XI. Recovery of *Coxiella burnetii* from milk of sheep. Pub. Health Rep. **65:** 395–399 (1950).
(*7*) Luoto, L., and Huebner, R. J.: Q fever studies in southern California. IX. Isolation of Q fever organisms from parturient placentas of naturally infected dairy cows. Pub. Health Rep. **65:** 541–544 (1950).

Salmonella mendoza: A New *Salmonella* Type

By R. H. Leiguarda, O. A. Peso, A. Z. R. de Pelazzolo, and E. M. Ansiaume*

Salmonella mendoza is represented by one culture isolated from the Mendoza River during the routine examination of samples of water from several places along the irrigation system of the province of Mendoza (R. Argentina).

The culture presented the typical biochemical reactions of the genus *Salmonella*. It was a motile rod which produced hydrogen sulfide, utilized d-tartrate, and failed to produce indol, to hydrolyze urea, or to liquefy gelatin.

The organism ferments glucose, arabinose, galactose, trehalose, maltose, xylose, mannose, levulose, dulcitol, inositol (variable), isodulcitol, and mannitol with production of acid and gas. Starch, dextrin, erythrol, adonitol, inulin, lactose, raffinose, sucrose, and salicin were not attacked.

The O antigens of *S. mendoza* were related to the O antigens of group D.[1] In absorption tests the organisms were able to remove all the O agglutinins from serum prepared with *S. gallinarum* (IX, XII). Likewise, *S. gallinarum* was able to absorb all agglutinins from an O serum prepared from *S. mendoza*.

The H antigens of the microorganism were diphasic and phase 1 was closely related to phase 1 of *S. bredeney* (l, v). In absorption tests *S. mendoza* reduced the titer of serum for phase 1 of *S. bredeney* from 10,000 to 20. The absorption of phase 1 serum of *S. mendoza* with *S. bredeney* phase 1 reduced the titer from 40,000 to less than 20. Phase 1 of *S. mendoza* can be denoted by the symbols l, v. Phase 2 was agglutinated in high dilution by phase 2 serum of *S. newport* (1,2 . . .) and in absorption tests *S. mendoza* reduced the titer of *S. newport* serum from 20,000 to 20. Absorption of serum prepared from phase 2 of *S. mendoza* by phase 2 of *S. newport* reduced the titer from 80,000 to less than 20. The antigens of phase 2 of *S. mendoza* are 1,2 . . . .

S. mendoza is pathogenic for mice only by intraperitoneal injection. A laboratory worker accidentally infected with *S. mendoza* had enteritis and diarrhea of 1 week's duration. The organism was iso-

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[1] The absorption of O and H related sera by *S. mendoza* was repeated by O. A. Peso in the laboratory of Dr. P. R. Edwards, Communicable Disease Center, Chamblee, Ga., before publication. We are in debt to Dr. Edwards for allowing us the use of his laboratory facilities and typing sera.

lated from the stools of the infected person during the acute stage of the infection, which subsided spontaneously.

Summary

S. mendoza is a new *Salmonella* type which was recovered from the water of the Mendoza River. It belongs to group D of the Kauffmann and White Schema and has the antigenic formula IX,XII: 1,v–1,2 . . . . Accidental ingestion of the organism resulted in enteritis and diarrhea which disappeared spontaneously after 1 week.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended October 13, 1951

The number of cases of typhoid fever being reported currently is well below that of a decade ago. In September 1951 the average per week was 60, while in 1940 the average number reported per week in September was about 160. The very marked summer peak has nearly disappeared leaving a more even distribution of cases throughout the year. Epidemiological investigation of the three cases reported by California for the current week suggests that a member of the family is a carrier in one case, another case is the second in a family previously reported, and the third occurred in a transient.

The number of cases of malaria reported for the current week was greater for civilians than for any week since September. The States reporting the largest numbers for the current week were Georgia (98), Michigan (17), Texas (13), and South Carolina (7). No information is available regarding previous military service in these cases. The number reported from military establishments closely approximates those for the previous 6 weeks.

The number of cases of poliomyelitis reported for the current week (1,062) is slightly above that for the previous week (1,016). The States in which an increase of more than 10 cases occurred, as compared with the previous week, were New York, Missouri, Kansas, North Carolina, Kentucky, Washington, and California. A secondary rise in the number of cases has occurred frequently in the fall months of past years.

The cumulative total number of cases of poliomyelitis for the calendar year is now 23,853 as compared with 26,505 for the same period in 1950. The cumulative total since the seasonal low week is 22,641 as compared with 25,374 for last year. If the present trend in the number of cases is maintained for the remainder of the year, approximately 30,000 cases will be reported in 1951 which would be about 3,000 less than in 1950.

One case of rabies in man, which was reported by Iowa, is stated to be a delayed report. The case occurred in June 1951.

Infectious Hepatitis

Dr. R. H. Hutcheson, Tennessee Commissioner of Health, has reported two outbreaks of infectious hepatitis. In a group of 300 pupils attending a rural school in Giles County, there were 25 cases, and among 400 pupils in a school in Wilson County, there were 100 cases. Investigations have indicated that both outbreaks were contact infections.

Gastroenteritis

Sarah V. Dugan, Kentucky State Department of Health, has reported an outbreak of gastroenteritis following a dinner in a hotel. Ten to 18 hours after eating, 90 persons became ill. The number attending the dinner was 130. No food was available for analysis, principally because 4 days elapsed before the outbreak was reported.

Dr. L. M. Shuman, Illinois Department of Health, has reported a food poisoning outbreak in Decatur in which cream-filled bismarks and coconut pies were shown to be the vehicles of infection. In the investigation by Dr. A. C. Baxter, it was found that 10 persons, of an estimated total of 100 who ate the pastry, became ill after an incubation period of 1½ hours. *Staphylococcus albus* was isolated from the pastries. The baker had an open sore on one hand, a culture of which yielded an organism identical with those found in the pastry.

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Oct. 20, 1951	Oct. 21, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	1	3	1	(1)	(1)	(1)	(1)	49	39	42
Diphtheria (055)	110	209	303	27th	1,070	1,556	2,725	3,078	4,681	7,334
Encephalitis, acute infectious (082)	28	21	15	(1)	(1)	(1)	(1)	863	781	529
Influenza (480–483)	292	733	733	30th	3,649	5,529	5,529	119,701	144,293	132,780
Measles (085)	1,498	998	922	35th	[2] 7,292	4,601	4,567	[2] 476,203	292,775	558,200
Meningitis, meningococcal (057.0)	65	72	62	37th	274	208	259	3,335	3,097	2,870
Pneumonia (490–493)	604	923	(3)	(1)	(1)	(1)	(1)	50,142	67,741	(3)
Poliomyelitis, acute (080)	1,062	1,548	1,078	11th	22,611	25,374	22,238	23,853	26,505	22,588
Rocky Mountain spotted fever (104)	3	3	3	(1)	(1)	(1)	(1)	[4] 314	401	532
Scarlet fever (050)[5]	771	778	1,028	32d	4,018	4,354	5,698	57,434	44,524	62,339
Smallpox (084)				35th		1	3	11	27	51
Tularemia (059)	11	8	15	(1)	(1)	(1)	(1)	547	753	799
Typhoid and paratyphoid fever (040, 041)[6]	61	56	70	11th	2,146	2,388	2,774	2,581	2,898	3,259
Whooping cough (056)	993	1,473	1,473	39th	[4] 2,674	4,366	4,366	[4] 56,449	101,561	80,438

[1] Not computed. [2] Deduction: Ohio, week ended Oct. 6, 39 cases. [3] Data not available.
[4] Additions: Rocky Mountain spotted fever—North Carolina, week ended Aug. 18, 1 case; Whooping cough—Kentucky, week ended Oct. 13, 10 cases and Rhode Island, week ended Oct. 6, 20 cases. [5] Includes cases reported as streptococcal sore throat. [6] Includes cases reported as salmonellosis.

The cream filling was made in the morning and placed on sale before noon.

Dr. Malcolm H. Merrill, California Department of Public Health, has reported 17 cases of *Shigella* infection in a rural area. The first case had its onset on August 1 and the last on October 8. Thirteen of the cases have been in children under 10 years of age.

Plague Infection in Grant County, Wash.

Dr. V. B. Link, Western Communicable Disease Center Laboratory, has reported that a specimen (51–WB–40), consisting of 199 fleas (*Megabothris clantoni, Meringis shannoi, Thrassis gladiolis johnsoni*, and *Catallagia charlottensis*) from 49 sagebrush voles (*Lagurus curtatus*) which were trapped October 2, 1951, 9 miles north of Quincey, Wash., was proved positive for plague.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Oct. 20, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480-483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490-493)	Poliomyelitis (080)
United States	**110**	**28**	**292**	**1,498**	**65**	**609**	**1,062**
New England	**2**		**1**	**217**	**1**	**24**	**16**
Maine	-	-	1	31		7	
New Hampshire	-		-	11	-	1	1
Vermont	-	-	-	61	-	-	-
Massachusetts	2	-	-	79	1	-	3
Rhode Island	-	-	-	11	-	-	1
Connecticut	-	-	-	21	-	16	11
Middle Atlantic	**10**	**11**	**1**	**443**	**11**	**96**	**127**
New York	5	6	(1)	295	6	-	82
New Jersey	3	2	1	71	3	56	14
Pennsylvania	2	3	-	77	2	40	31
East North Central	**4**	**2**	**15**	**274**	**15**	**65**	**231**
Ohio	1	-	-	39	5	-	48
Indiana	2	-	13	8	-	11	14
Illinois	1	-	1	110	5	37	54
Michigan	-	2	1	52	5	17	64
Wisconsin	-	-	-	65	-	-	51
West North Central	**2**	**1**	**1**	**30**	**9**	**51**	**152**
Minnesota	2	-	-	11	3	16	27
Iowa	-	1	-	-	2	6	10
Missouri	-	-	-	3	3	1	40
North Dakota	-	-	-	1		24	2
South Dakota	-	-	1	4	-	-	4
Nebraska	-	-	-	2	-	-	19
Kansas	-	-	-	9	1	4	50
South Atlantic	**46**	**3**	**11**	**144**	**8**	**60**	**76**
Delaware	-	-	-	3	-	-	-
Maryland	1	-	-	53	-	13	7
District of Columbia	-	-	-	13	-	4	3
Virginia	11	1	-	25	3	30	9
West Virginia	1	-	-	11	-	-	11
North Carolina	17	1	-	8	2	-	17
South Carolina	2	-	2	1	-	1	6
Georgia	13	1	9	27	-	12	18
Florida	1	-	-	3	3	-	5
East South Central	**23**	**1**	**5**	**48**	**5**	**36**	**97**
Kentucky	8	-	-	31	1	3	28
Tennessee	3	-	-	7	3	-	36
Alabama	10	-	-	7	-	21	8
Mississippi	2	1	5	3	1	12	25
West South Central	**20**	**4**	**81**	**43**	**9**	**165**	**97**
Arkansas	2	2	62	2	1	10	10
Louisiana	4	-	-	-	2	9	23
Oklahoma	2	-	19	3	-	10	13
Texas	12	2	-	38	6	136	51
Mountain	**1**	-	**127**	**142**	-	**60**	**69**
Montana	-	-	10	21	-	-	1
Idaho	-	-	-	8	-	-	8
Wyoming	-	-	-	-	-	2	4
Colorado	-	-	28	13	-	20	17
New Mexico	-	-	2	37	-	26	8
Arizona	1	-	87	33	-	12	6
Utah	-	-	-	30	-	-	23
Nevada	-	-	-	-	-	-	2
Pacific	**2**	**6**	**50**	**157**	**7**	**52**	**197**
Washington	-	-	34	28	2	4	20
Oregon	1	-	8	32	-	20	22
California	1	6	8	97	5	28	155
Alaska	-	-	-	-	-	-	-
Hawaii	-	1	42	302	-	-	1

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Oct. 20, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040,041)	Whooping cough (056)	Rabies in animals
United States	3	771		11	61	993	134
New England		34			9	46	
Maine		3			1	5	
New Hampshire		3				2	
Vermont						2	
Massachusetts		20			8	32	
Rhode Island		1					
Connecticut		7				5	
Middle Atlantic	1	88			5	209	13
New York	1	49			2	91	13
New Jersey		13			2	58	
Pennsylvania		26			1	60	
East North Central		189		3	4	219	11
Ohio		49				27	5
Indiana		25				17	4
Illinois		35		3	2	47	2
Michigan		68			2	72	
Wisconsin		12				56	
West North Central		60				25	19
Minnesota		9				3	7
Iowa		10				2	6
Missouri		13				11	5
North Dakota							
South Dakota		18					
Nebraska		1				1	1
Kansas		9				8	
South Atlantic	2	152		2	11	98	20
Delaware						2	
Maryland		11			1	3	
District of Columbia		5				1	
Virginia		15		1	3	21	6
West Virginia		9				14	1
North Carolina	2	81			1	13	
South Carolina		12		1	1		8
Georgia		19			4	28	5
Florida					1	16	
East South Central		66			10	38	24
Kentucky		19			2	10	8
Tennessee		41			3	16	5
Alabama		5			1	5	6
Mississippi		1			4	7	5
West South Central		11		2	4	213	47
Arkansas		1				28	1
Louisiana				1		6	[3] 12
Oklahoma		1			2	15	4
Texas		9		1	2	164	30
Mountain		26		4	2	53	
Montana		2				3	
Idaho		3				14	
Wyoming						2	
Colorado		9				10	
New Mexico		2			2	15	
Arizona		8				9	
Utah		2		4			
Nevada							
Pacific		145			16	92	
Washington		18				11	
Oregon		11			1	3	
California		116			15	78	
Alaska					1	8	
Hawaii					1	2	

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.
[3] Report for September.
Rabies in man: Iowa, 1 case.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended October 6, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	11					3	4				4
Chickenpox	311			4		23	137	8	25	62	52
Diphtheria	3				1	2					
Dysentery, bacillary	11	3									8
Encephalitis, infectious	1					1					
German measles	54			1		9	15		7	9	13
Influenza	29			23			1	4			1
Measles	449	4		39	2	82	47	2	9	135	129
Meningitis, meningococcal	5	1			1	3					
Mumps	218	1				27	100	10	28	14	38
Poliomyelitis	97			6	6	11	54	7	5	2	6
Scarlet fever	193					46	23	25	23	24	52
Tuberculosis (all forms)	192	8		3	21	62	18	17	9	11	43
Typhoid and paratyphoid fever	18				8	9			1		
Venereal diseases:											
Gonorrhea	322	11		10	3	101	59	21	15	44	58
Syphilis	59	2		1	4	28	5	2	4	1	12
Primary	7					3			2	1	1
Secondary	2								2		
Other	50	2		1	4	25	5	2			11
Other forms	1										1
Whooping cough	219			2	1	79	65	17	20	27	8

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occu rence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports o 1 yellow fever are published currently.

Plague

India. For the week ended September 29, 1951, 29 cases (10 deaths) of plague were reported in Mysore State as compared with 67, 66, and 18 cases for the first 3 weeks of the month. There were 104 cases (30 deaths) reported in the whole country for the week ended September 8.

Union of South Africa. During the period September 14–20, two fatal cases of bubonic plague were reported in the Maraisburg District, Cape Province.

Smallpox

Ecuador. During August, 10 cases of smallpox were reported, 2 of which were in the airport of Quito.

India (French). Nine cases of smallpox were reported in Karikal during the period September 21–30.

Indochina. For the week ended October 13, 19 cases of smallpox were reported in Hanoi, Viet Nam, and 2 were reported in Haiphong.

Rhodesia, Northern. During the week ended October 6, six cases of smallpox were reported in Northern Rhodesia.

Typhus Fever

Ecuador. For the month of August, 72 cases (8 deaths) of typhus fever were reported in Ecuador. Of these, 16 were in Quito and 1 murine type was in Quayaquil.

Eritrea. For the week ended October 6, four cases of typhus fever were reported in Eritrea.

Yellow Fever

Ecuador. During the period August 1–15, 1951, one fatal case of jungle yellow fever was reported in Calceta, Bolivar County, Manabi Province.

French West Africa. On October 13, one suspected case of yellow fever was reported in Guinea. This is the first case to be reported in the area; however, in February a suspected case was reported in Freetown, Sierra Leona. The patient was said to have been from Timbo, Guinea.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
Price 15 cents. Subscription price per year—$4.75, domestic; $6.25 foreign.

Public Health Reports

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FEDERAL SECURITY AGENCY

PUBLIC HEALTH SERVICE

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Oscar R. Ewing, Administrator

PUBLIC HEALTH SERVICE

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Division of Public Health Methods

G. St. J. Perrott, Chief of Division

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Public Health Reports

Vol. 66 • NOVEMBER 16, 1951 • No. 46

Trends and Epidemics of Influenza and Pneumonia, 1918–1951

By SELWYN D. COLLINS, Ph.D., and JOSEPHINE LEHMANN*

The virus of human influenza was isolated in 1933 and 1934, following intranasal instillation of throat washings in ferrets, by Smith, Andrewes, and Laidlaw (*1*, *16*). In the late summer of 1934 their evidence was first corroborated in the United States in the laboratories of the Rockefeller Institute (*8*) by the recovery of a strain of the same virus from an epidemic in Puerto Rico. Since that time several strains and types of influenza virus have been isolated, and from materials from patients in epidemics in 1932 and later years the predominant type of virus has been determined (*7*).

Although simplified methods of concentrating and purifying influenza virus have been developed (*9*), it is not practicable at present to use virus findings on individual patients as an aid in diagnosis, as is done with throat cultures in diagnosing diphtheria. However, if a considerable number of patients in an apparent influenza epidemic are tested for influenza virus, it can be stated whether the epidemic was predominantly due to virus A, A′, B, or some unknown type. Of the epidemics since 1932, the most common predominant etiologies have been viruses A and A′, and more frequently the latter since 1940.

Another development which must have profoundly affected the trend of influenza and pneumonia mortality was the discovery and use of the sulfonamides, penicillin, and other newer chemotherapies in the treatment of the disease. The literature on this subject is extensive but a few studies on pneumonia among humans may be cited. Some early reports on sulfanilamide therapy on human cases of pneumonia were made by Heintzelman, Hadley, and Mellon (*11*) and Price (*12*); on sulfanilamide and serum treatment by Price and Myers (*13*), and on serum treatment by Rogers and Gooch (*14*).

Obviously, studies of influenza prior to 1933 and 1934, when the virus was first isolated, were rather largely descriptive of the nature of the outbreaks, including explosiveness, extent of the epidemic in terms of deaths in excess of normal seasonal expectancy, cases reported

*From the Division of Public Health Methods, in cooperation with the National Office of Vital Statistics, Public Health Service.

to health officers or estimated from household surveys immediately following the epidemic, time covered by the outbreak, regions or States where the epidemic was first noted, and the time and directi of its spread—in the sense of the time between the peaks in the and last regions affected.

It soon became apparent that influenza reported to health ments was a poor index of the relative importance of the epidemics and of their intensity in the various geographi Influenza was very poorly reported between epidemics, were greatly increased as soon as the epidemic was in p fact, it was often said that influenza was diagnosed by its e rather than its clinical course. There were many argum epidemiologists as to whether the great pandemic of 191 the same etiology as the epidemics of 1920–29, or the sa epidemics of the early '90's, or an entirely new disease. Al there was no laboratory evidence of the etiology of the pandemic of 1918–19 and the epidemics of 1920–29, Francis (*7*) points out that epidemiological and other characteristics of the disease in 1918 are such as to warrant calling it and the epidemics following it the same disease.

From household surveys following influenza epidemics, considerable information was obtained about age incidence of influenza and pneumonia, case fatality, complications, and other epidemiological features of the disease, but it was not possible even if profitable to organize such surveys quickly enough to get accurate data about each epidemic.

In the absence of other data, epidemiologists and statisticians turned to weekly reports of deaths from influenza and pneumonia in excess of the normal seasonal expectancy as an index of the size of an epidemic. The present study is largely a review of influenza epidemics as measured by this method, together with a consideration of trends of mortality from influenza and pneumonia aside from and also including excess deaths during epidemics.

Influenza itself has never been one of the consistently large killers, but combined with pneumonia, its most frequent complication, it caused an annual average of 184 deaths per 100,000 population of the registration States in the years 1900–1904. In the older ages, many persons with chronic diseases were and still are easy prey for the influenza-pneumonia combination. Aside from the pandemic of 1918–19, and to a considerably lesser extent the epidemics of 1920 and 1922, the mortality has been relatively low in youth and young adulthood and highest in the older ages.

Trend of Influenza and Pneumonia Mortality, 1900–1951

With the exception of the pandemic of 1918–19 and its more than half-million deaths above normal expectancy (*17*), and the moderate

epidemics of the next 18 years, the most striking development in influenza and pneumonia is the abrupt acceleration in the downward trend of mortality in the late '30's. In figure 1 the continuous line

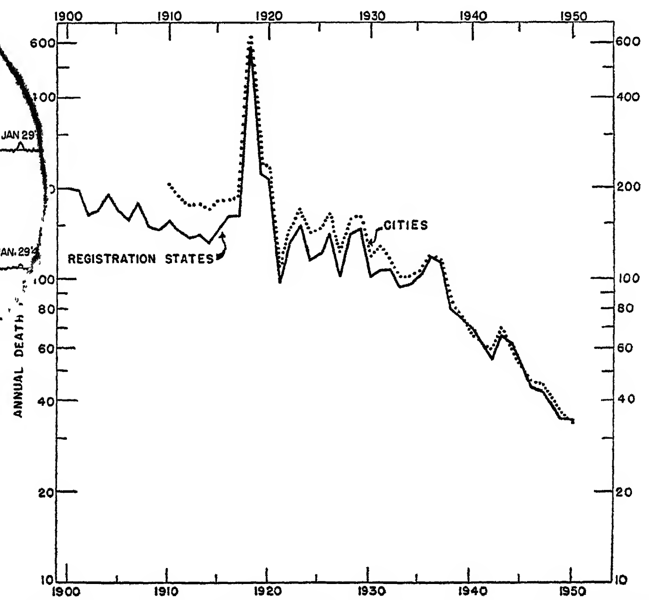

Figure 1. **Trend of mortality from influenza and pneumonia in the registration States 1900–50, and in groups of cities in the United States, 1910–50.**

NOTE: Logarithmic vertical scale. Rates are for calendar years; 35 cities 1910–19; 90 cities 1920–42; 56 cities 1943–50. Registration States rates for 1949 and 1950 are estimated from the 10-percent sample (*18*, fifth revision of International List) on the basis of the change in that rate since 1948. For years prior to 1942, see table 2 of reference (*10*) and (computed from) table 4 of reference (*6*). The number of registration States increases from year to year.

shows the total annual death rates from influenza and pneumonia in the registration States for calendar years from 1900 to 1950 (table 1 and references therein). Aside from 1918, 1919, and 1920, there is a generally downward trend from 1900 to about 1937 which tends to follow a straight line from the 184 annual deaths per 100,000 in 1900–1904 to roughly 100 in 1937. Just after that year there is a definite and abrupt change in the general slope of the curve with a decline in the rate from about 100 per 100,000 to a provisional low of about 34 in 1950, estimated from the 10-percent sample [1] of death certificates (*18*). Although the 10-percent sample indicates no decline in 1950 from 1949, data for the 56 large cities for which deaths from influenza and pneumonia are available indicate a continuation of the decline in 1950, as can be seen by the dotted line in figure 1.

Data on influenza and pneumonia deaths for the decade 1910–19

[1] Fifth revision of the International List was used for making 1949 and 1950 estimates comparable with earlier years (see note to fig. 1).

Table 1. *Annual mortality from influenza and pneumonia in the registration States and in 56 cities in the United States, 1942–50* [1]

Calendar year	Annual death rate per 100,000		Calendar year	Annual death rate per 100,000	
	Registration States	Cities		Registration States	Cities
1942 [1]	55.7	58.5	1947	[illegible]	[illegible]
1943	67.3	70.0	1948	[illegible]	[illegible]
1944	61.7	60 1	1949 [2]	[illegible]	[illegible]
1945	51.8	51.3	1950 [2]	[illegible]	[illegible]
1946	44.6	46.6			

[1] For years prior to 1942, see table 2 of reference (*10*) and (computed from) table 4 of refer[illegible]
[2] Registration States rates for 1949 and 1950 are estimated from the 10-percent sample on[illegible] change in that rate since 1948. The fifth revision of the International List is used in th[illegible] correspond with the years prior to 1949. The rates according to the sixth revision were 27.5[illegible] for 1950.

are available for 35 large cities at monthly intervals to Septe[illegible] 1918. Weekly data are available from September 8, 1918, through 1919. From 1920 to August 1942, weekly data are available for about 90 cities, including a majority of those over 100,000 in population and some smaller cities, particularly in areas like the Mountain States where there are few large cities. From August 1942 to the present, weekly data are available for 56 cities of 100,000 population or more. Since no tabulations have ever been made on weekly data for the United States as a whole, these deaths for groups of cities are the only data available for accurately measuring the extent of the excess over normal seasonal expectancy of influenza and pneumonia during epidemics.[2]

The dotted line in figure 1 shows total annual death rates from influenza and pneumonia in these groups of cities from 1910 to 1950. Prior to 1920 the city rates are considerably higher and they show less downward trend from 1910 to 1917 than the rates for the registration States as a whole. However, after September 8, 1918, the city data are available by weeks, and weekly data are important in studying epidemics of a disease which may cover the country in as few as 10 weeks. So far as epidemics are concerned, the curves for the cities and for the registration States seem to indicate about the same outbreaks; in the later years of the period the two sets of data are similar in the actual level of the rates.

Figure 2 shows for the groups of cities described above the trend of annual influenza and pneumonia death rates for years ending in mid-August of 1920 to 1951 in terms of total rates and in rates exclusive of the excess during epidemics (table 2). Rates for the year ending in August of 1951 are estimated from data for the first 39 weeks of the

[2] Data on influenza and pneumonia mortality in Massachusetts are available at monthly intervals for many years, including the epidemics of the early '90's. Aside from epidemic variation these data show no long-time trend from 1887 to 1910 (*2*).

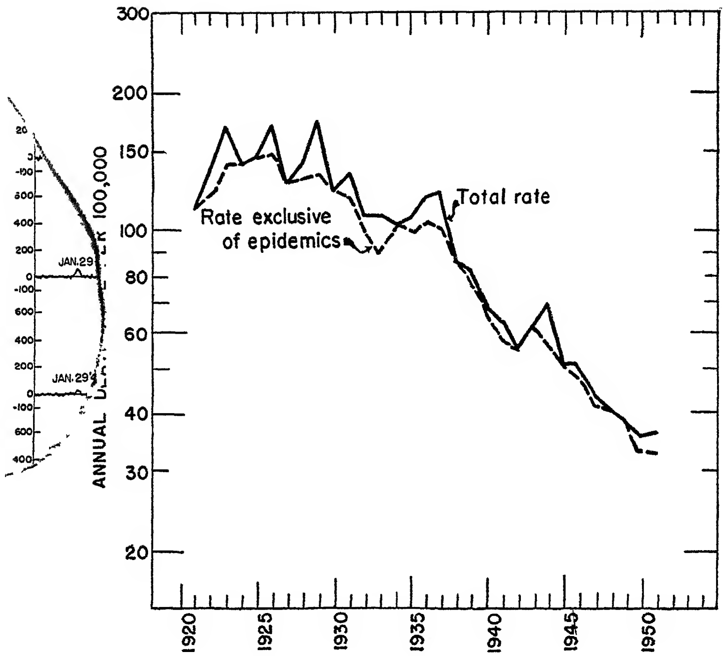

Figure 2. Trend of mortality from influenza and pneumonia in groups of cities in the United States, including and excluding epidemic excess deaths, 1920–51.

NOTE: Logarithmic vertical scale. Rates are for years ending in mid-August, i. e., 32d week of the calendar year; 90 cities 1920–42; 56 cities 1943–51. Rate for year ending in mid-August of 1951 estimated on the basis of the change in the rate for the first 9 months of that year from the rate for the first 9 months of the year ending in mid-August of 1950. For years prior to 1943, see tables 1 and 3 of reference (*10*).

years ending in August of 1950 and 1951. Whether total rates or rates exclusive of epidemic excesses are used, the acceleration in the downward trend since about 1937 is unmistakable.

Figure 3 shows for large cities the trend by quarters for the years 1935 to 1951, exclusive of epidemic excess deaths (table 3). As would be expected the winter quarter (January–March) has the highest rates

Table 2. *Annual mortality from influenza and pneumonia in 56 cities of the United States, 1943–51* [1]

Year ending in mid-August (thirty-second week)	Annual death rate per 100,000: Including epidemic excess deaths	Annual death rate per 100,000: Excluding epidemic excess deaths	Year ending in mid-August (thirty-second week)	Annual death rate per 100,000: Including epidemic excess deaths	Annual death rate per 100,000: Excluding epidemic excess deaths
1943 [1]	62.2	62.2	1948	41.4	41.4
1944	70.4	56.0	1949	38.9	38.9
1945	51.4	51.4	1950	35.6	32.9
1946	51.2	47.5	1951 [2]	36.1	32.4
1947	44.4	41.9			

[1] For years prior to 1943, see tables 1 and 3 of reference (*10*).
[2] The rate for 1951 is estimated on the basis of the change in the rate for the first 9 months of the year ending in mid-August of 1950–51 from the rate for the same period of 1949–50.

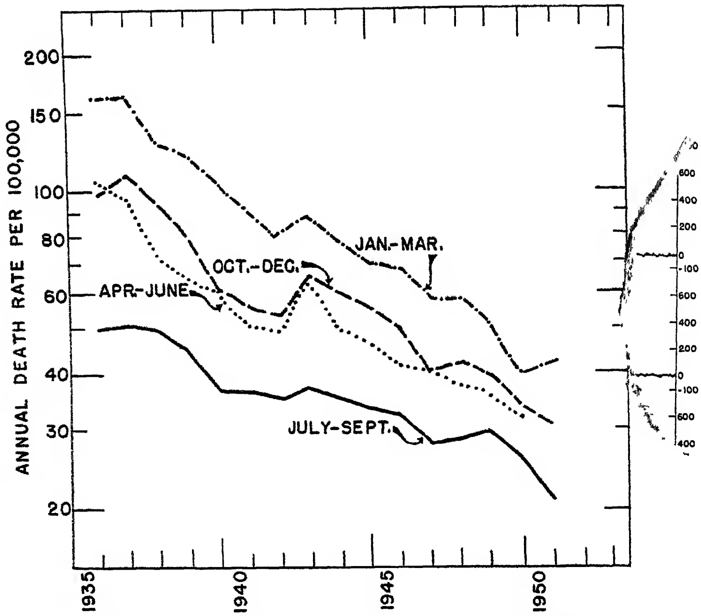

Figure 3. Trend of mortality from influenza and pneumonia, exclusive of epidemic excess deaths, for each quarter-year in groups of cities in the United States, 1935–51.

NOTE. Logarithmic vertical scale: 90 cities 1935–42, 56 cities 1943–51. For years prior to 1943, see table 4 of reference (10).

(annual basis), but it has also the steepest decline. The rates for the two adjacent quarters (October–December and April–June) have roughly the same slopes but less relative decline than those of the winter quarter. The rates for the low summer quarter decline less rapidly than those for the other quarters.

Figure 4 shows total influenza and pneumonia death rates in large cities classified into eight geographic sections (table 4). The light line

Table 3. *Quarterly mortality per 100,000 (annual basis) from influenza and pneumonia exclusive of epidemic excess deaths, in 56 cities of the United States, 1942–51* [1]

Year[1]	Third quarter (27–39 weeks) July–September	Fourth quarter (40–52 weeks) October–December	First quarter (1–13 weeks) January–March	Second quarter (14–26 weeks) April–June
1942–43 [2]	37.3	65.8	88.1	62.3
1943–44	35.0	59.3	79.7	50.5
1944–45	33.7	55.8	70.2	46.5
1945–46	32.4	50.7	67.1	41.8
1946–47	28.4	40.7	58.0	40.4
1947–48	28.7	42.3	58.0	37.3
1948–49	29.9	39.8	50.6	35.8
1949–50	26.3	34.1	40.6	32.5
1950–51	21.4	30.9	43.1	----------

[1] Rates (total, normal, and excess) were computed for years ending in mid-August (thirty-second week), but these quarterly rates represent averages for the weeks in standard quarters as indicated by the column headings.
[2] For years prior to 1943, see table 4 of reference (10).

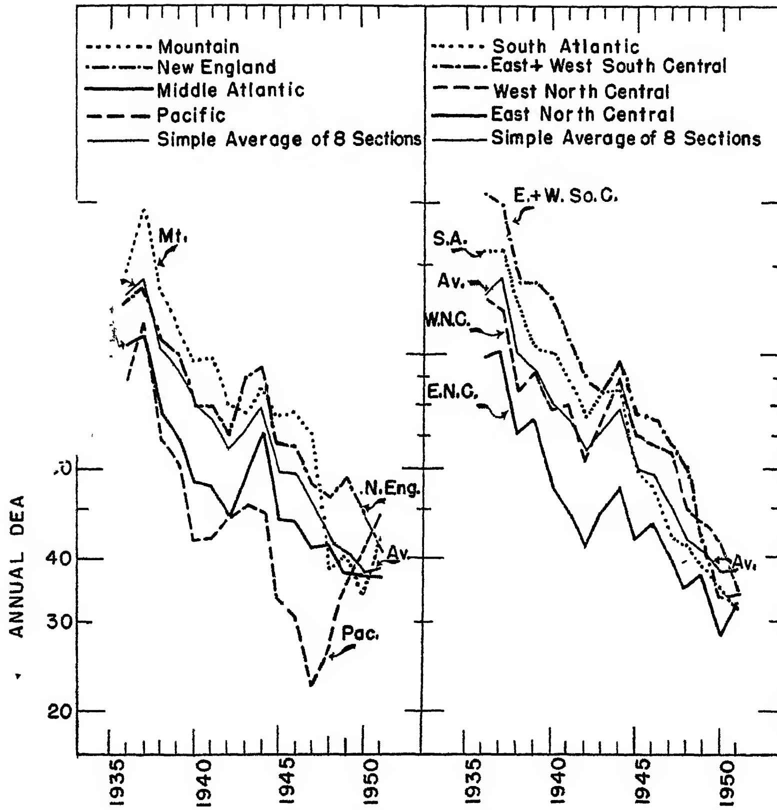

Figure 4. Trend of mortality from influenza and pneumonia in cities in each of eight geographic sections of the United States, 1935–51.

NOTE: Logarithmic vertical scale. U. S. Census geographic sections are used except that East and West South Central are combined. Rates are for years ending in mid-August, i. e., 32d week of the calendar year; 90 cities 1935–42; 56 cities 1943–51. For years prior to 1943, see table 3 of reference (10).

appearing on both halves of the chart is the simple average of the rates in the eight sections, intended to serve as a base line for indicating which sections have higher and which lower rates than the average. Nearly every section shows a generally downward trend in death rates from influenza and pneumonia, aside from epidemic peaks and chance variations. The sole exception is the Pacific section, which declines rapidly to a very low rate for the year ending in mid-August of 1947 but increases in each of the four following years.

Excess Mortality from Influenza and Pneumonia

Since 1918 and even earlier, excess mortality has been used as the best available measure of epidemic periods and of the size and importance of an epidemic. This method involves the finding of a normal seasonal expectancy for influenza and pneumonia mortality

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Table 4. *Annual total mortality per 100,000 from influenza and pneumonia in cities of eight geographic sections of the United States, 1943–51* [1]

Year ending in mid-August (thirty-second week)	All 56 cities	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East and West South Central	Mountain	Pac[illegible]
1943 [1]	62 2	92.7	57.6	49.2	74.6	84.4	84.6	77.1	[illegible]
1944	70.4	95.4	70.0	55.5	89 7	85.3	96.6	86.[illegible]	[illegible]
1945	51.4	67.1	47.5	43.2	69.8	59.5	77.5	76[illegible]	[illegible]
1946	51.2	66 6	47.6	46.7	66.2	55 3	75 8	7[illegible]	[illegible]
1947	44.4	56.9	41.9	40.2	65 0	44.4	67.2	6[illegible]	[illegible]
1948	41.4	52 9	42.6	35.0	50.0	42.5	60.9	3[illegible]	[illegible]
1949	38.9	57 7	37.0	37.0	46.4	38.4	42 2	4[illegible]	[illegible]
1950	35.6	48 9	36.4	28.5	42 6	34.6	33.3	[illegible]	[illegible]
1951 [2]	36.1	41.2	36.2	32.3	34.6	31.7	33.6	[illegible]	[illegible]

[1] For years prior to 1943, see table 3 of reference (*10*).
[2] See note 2 to table 2.

and measuring the epidemic by the excess over this seasonal [illegible]ancy.[3] In an early study (*4*) it was found that roughly half of t[illegible] excess mortality credited to influenza and pneumonia during an influenza epidemic was charged to pneumonia and the other half to influenza. In fact, influenza may well be thought of as not a killing disease except by the intervention of pneumonia or the presence of chronic disease in the patient. A later study indicated that in small and moderate influenza epidemics, many of the excess deaths are credited to the chronic diseases of the older ages (*3*), presumably because of the high mortality of influenza and pneumonia among persons with chronic disease.

In and around the pandemic of 1918–19, the excess mortality method was used on weekly influenza and pneumonia death rates back to the late '80's in an effort to compare the epidemics of the early '90's and the early 1900's with excesses in the pandemic of 1918–19 (*19*).

Figure 5 shows excess death rates by weeks from influenza and pneumonia from 1918 to 1951 for the total of the various groups of cities described in an earlier section of this report. Aside from the great pandemic of 1918–19, the two largest epidemics occurred early in 1920 and in the winter of 1928–29. However, three other epidemics of considerable size occurred in the decade 1920–29 and three in the decade 1930–39. In the period 1940–51, only the epidemic of 1943–44 was comparable in size with the ones occurring in the two preceding decades.[4] However, minor epidemics were scattered throughout the whole range of years; counting all sizes which showed a measurable excess in the group of cities as a whole, the epidemic of 1951 was the

[3] For details of the methods used, see appendix to this report.
[4] The considerable number of exceptionally large deviations below seasonal expectancy which occurred in the decade 1920–29 are the result of a difference in the method of estimating the seasonal expectancy. In 1920–29 there was little trend in the rates for the cities and no attempt was made to adjust the curve of expectancy to the level of the nonepidemic rates for the year under consideration. The closer fit in the two decades 1930–50 comes from the adjustment of the seasonal norm to the level of the nonepidemic rates, first by years and later by quarters. For details of method, see appendix.

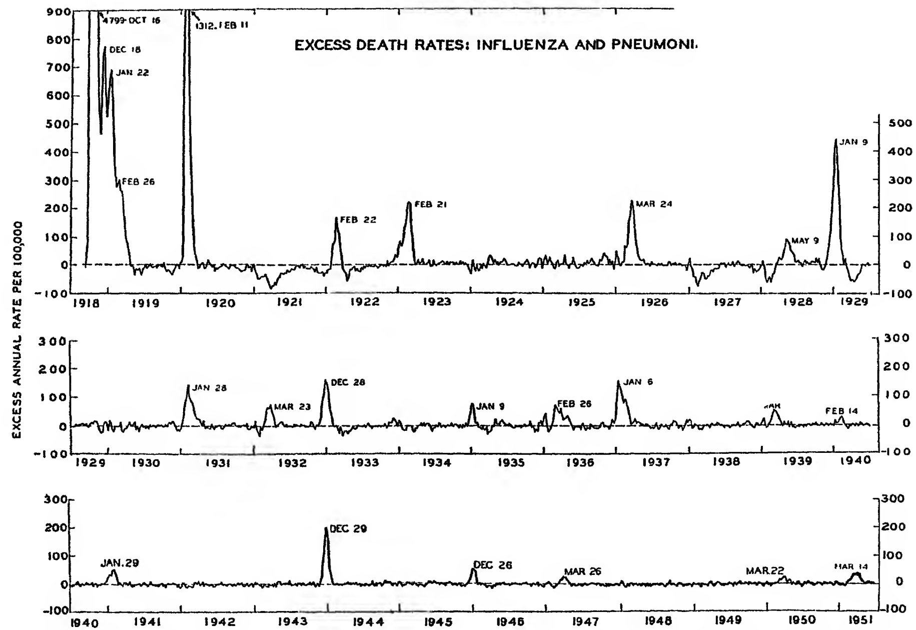

Figure 5. Weekly excess mortality (annual basis) from influenza and pneumonia in groups of cities in the United States, September 1918 to May 1951.

NOTE: Dates on charts are middle, Wednesday, of peak weeks. In 1920–29 excess rates are deviations from the smoothed median rate for corresponding weeks for the period 1921–27; in 1930 and later years they are deviations from average rates for corresponding weeks of years exclusive of or without serious epidemics, with adjustment for the downward trend in nonepidemic rates. See appendix to this study and references (*4, 5, 10, 18*) for details of computation; 35 cities 1918–19; 90 cities 1920–42, 56 cities 1943–51. Note that rate scale on this chart is twice the scales on the similar charts by geographic sections.

twentieth outbreak since the pandemic of 1918–19. This count includes some extremely small outbreaks such as that of March 1947 and March 1950, but it excludes three epidemics which affected some geographic regions but did not show appreciable excess when cities were combined into one group.

By summating weekly excess rates computed on an annual (fig. 5) and reducing the total from an annual to an actual be can make a fair estimate of the total deaths charged to influ pneumonia in excess of seasonal expectancy during the whc of a given outbreak. Table 5 includes such a summary. Cc all cities combined, the excess influenza and pneumonia epidemics since 1918–19 ranged in total excess deaths pe from 99.3 for the 1920 epidemic to 1.9 for a small epidemic of and February of 1940 which affected only four geographic regio 2.5 for the epidemic of February–April of 1947; the three epide which involved only two geographic sections and showed no excess for the group of cities as a whole are not counted in this total.

Referring again to figure 5 and table 5, it should be noted that with the exception of the small epidemic of March to May of 1928 all the other outbreaks in the decade 1920-29 are larger in terms of total excess influenza and pneumonia deaths than any that have occurred since that time. It is equally apparent that in the decade 1930–39 more and larger epidemics occurred than in the period 1940–51—in fact, the only epidemic of any size that occurred since the beginning of 1940 was that of 1943–44. Thus, it appears that one or more of several things may have happened: (1) the mortality of diseases designated as influenza may be decreasing by reason of change in what is now diagnosed as influenza because of recently acquired knowledge of the etiology and the early clinical manifestations of the disease; (2) influenza fatality may be becoming less by reason of (*a*) greater natural immunity acquired by more individual contact because of greater movement of the population; (*b*) milder strains of the virus becoming widespread; or (*c*) more successful treatment of influenza and its most frequent complication, pneumonia, by the use of the newer chemotherapies.

Epidemics in Different Geographic Sections

The method of excess mortality from influenza and pneumonia has been applied to the data for each geographic section of the country. Figure 6 covers the period 1920–30 in each of the nine census sections; figures 7 and 8 include, roughly, the next two decades, bringing the record up to May 1951. The major epidemics, such as those of early 1920 and of the winter of 1928–29, show up in every geographic section, and the same is true of many of the epidemics that are minor in terms of excess death rates. For example, the 1922 epidemic

Table 5. *Summary of period covered by epidemics and of the excess [1] mortality from influenza and pneumonia in epidemics in groups of cities [2] in the United States, 1920–51*

… of epidemic and geographic section	Total excess morality during whole epidemic per 100,000 population [3 4]	Date of middle (Wednesday) of peak week	Actual excess [3] per 100,000 for peak week	Total number of weeks included	Approximate dates of epidemic: Beginning	Approximate dates of epidemic: End
	99.3	Feb. 11	25.2	12	Jan. 4	Mar. 27
…d	96.6	---do---	26.2	12	Jan. 11	Apr. 3
…ntic	95.2	---do---	26.5	8	Jan. 18	Mar. 13
…Central	109.4	Feb. 4	32.5	11	Jan. 4	Mar. 20
…Central	121.9	Feb. 11	33.0	12	---do---	Mar. 27
…ic	94.2	Feb. 18	24.4	9	Jan. 11	Mar. 13
…Central	99.1	Feb. 25	24.5	11	---do---	Mar. 27
…Central	91.2	Feb. 11	19.5	12	---do---	Apr. 3
	159.5	---do---	50.8	14	Jan. 4	Apr. 10
	57.7	---do---	15.5	11	Jan. 18	Apr. 3
…1–22: [3 4]						
…es	18.3	Feb. 22	3.20	12	Jan. 8	Apr. 1
…England	29.5	Mar. 1	6.62	13	Jan. 15	Apr. 15
Middle Atlantic	24.7	Feb. 22	3.97	14	Jan. 8	Do.
East North Central	11.4	Mar. 8	1.61	10	Jan. 15	Mar. 25
West North Central	34.8	Feb. 22	5.35	12	Jan. 1	Do.
South Atlantic	9.4	Mar. 29	1.28	8	Feb. 19	Apr. 15
East South Central	16.0	Feb. 22	1.28	14	Dec. 18	Mar. 25
West South Central	14.6	Mar. 8	3.18	5	Feb. 26	Apr. 1
Mountain	36.2	---do---	9.07	11	Jan. 29	Apr. 15
Pacific	36.3	Feb. 22	10.15	9	---do---	Apr. 1
Winter 1922–23: [3]						
All cities	29.9	Feb. 21	4.22	17	Nov. 26	Mar. 24
New England	36.6	Jan. 31	3.97	17	---do---	Do.
Middle Atlantic	26.5	Feb. 28	4.83	16	Dec. 3	Do.
East North Central	32.2	Feb. 21	4.79	14	Dec. 10	Mar. 17
West North Central	53.3	Feb. 28	7.96	18	Nov. 26	Mar. 31
South Atlantic	42.7	Feb. 7	5.02	17	---do---	Mar. 24
East South Central	44.0	Jan. 31	5.50	20	Dec. 31	May 19
West South Central	6.7	Feb. 28	2.40	10	Jan. 14	Mar. 24
Mountain	17.6	Feb. 21	3.05	14	Dec. 31	Apr. 7
Pacific	11.3	Feb. 28	2.11	9	Feb. 4	Do.
Winter 1925–26: [3]						
All cities	25.3	Mar. 24	4.33	17	Jan. 31	May 29
New England	30.0	Mar. 31	6.88	15	Mar. 7	June 19
Middle Atlantic	41.2	Mar. 24	6.73	16	Feb. 14	June 5
East North Central	22.2	---do---	4.18	14	Mar. 7	June 12
South Atlantic	26.2	Feb. 17	5.95	18	Dec. 20	Apr. 24
East South Central	38.2	Mar. 24	7.12	17	Feb. 14	June 12
West South Central	58.8	Feb. 10	9.88	20	Nov. 8	Mar. 27
Mountain	16.8	Feb. 24	4.24	11	Dec. 27	Mar. 13
Pacific	9.3	Jan. 6	2.07	9	---do---	Feb. 27
Spring 1928: [3]						
All cities	11.6	May 9	1.75	19	Mar. 11	July 21
New England	15.4	May 23	3.11	12	Apr. 29	Do.
Middle Atlantic	20.9	May 9	2.53	19	Mar. 11	Do.
East North Central	17.9	---do---	2.80	13	Mar. 18	June 16
West North Central	4.9	May 2	1.17	10	Apr. 8	Do.
East South Central	11.9	May 23	2.99	9	Apr. 15	Do.
West South Central	13.7	Mar. 21	1.69	13	Mar. 11	June 9
Mountain	7.7	Feb. 29	1.57	14	Feb. 26	June 2
Winter 1928–29:						
All cities	44.4	Jan. 9	8.44	12	Nov. 25	Feb. 16
New England	42.3	Jan. 23	9.72	9	Dec. 30	Mar. 2
Middle Atlantic	43.0	Jan. 9	7.21	11	Dec. 2	Feb. 16
East North Central	43.7	Jan. 2	10.61	10	Nov. 25	Feb. 2
West North Central	42.8	Jan. 9	6.16	13	Dec. 2	Mar. 2
South Atlantic	47.6	---do---	11.20	10	---do---	Feb. 9
East South Central	92.0	---do---	28.84	9	---do---	Feb. 2
West South Central	68.2	Jan. 2	19.91	10	Nov. 25	Do.
Mountain	68.7	Dec. 12	22.19	9	Nov. 18	Jan. 19
Pacific	43.0	Dec. 5	9.00	13	Oct. 21	Do.
Winter 1930–31:						
All cities	16.4	Jan. 28	2.78	16	Dec. 28	Apr. 18
New England	13.8	Feb. 4	3.32	8	Jan. 11	Mar. 7
Middle Atlantic	24.3	Jan. 28	5.22	14	Dec. 28	Apr. 4
East North Central	9.7	Feb. 25	1.78	10	Jan. 11	Mar. 21
West North Central	14.0	---do---	2.15	11	Feb. 15	May 2
South Atlantic	27.2	Feb. 11	4.43	16	Dec. 28	Apr. 18
West South Central	17.7	---do---	1.99	16	---do---	Do.

See footnotes at end of table.

Table 5. *Summary of period covered by epidemics and of the excess [1] mortality from influenza and pneumonia in epidemics in groups of cities [2] in the United States, 1920–51*—Continued

Date of epidemic and geographic section	Total excess mortality during whole epidemic per 100,000 population [3 4]	Date of middle (Wednesday) of peak week	Actual excess [3] per 100,000 for peak week	Total number of weeks included	Approximate d of epidemi	
					Beginning	
Early 1932:						
All cities	7.4	Mar. 23	1.40	9	Feb.	
Middle Atlantic	13.5	Mar. 9	2.47	10	do.	
East North Central	4.6	Mar. 2	1.23	7	do	
West North Central	19.4	Feb. 17	3.41	13	Jan.	
South Atlantic	8.0	Mar. 23	1.99	7	Feb.	
East South Central	8.6	Apr. 6	2.03	10	Mar.	
West South Central	7.2	Mar. 23	1.99	6	Feb.	
Mountain	24.1	Jan. 6	4.05	17	Dec.	
Winter 1932–33:						
All cities	19.2	Dec. 28	3.15	11	Nov. 20	
New England	22.8	Jan. 25	5.54	10	Dec. 4	
Middle Atlantic	18.1	Jan. 11	3.53	11	Nov. 27	
East North Central	13.8	Dec. 28	2.68	12	Nov. 6	Jan.
West North Central	42.7	do	7.75	15	Nov. 20	Mar. 4
South Atlantic	22.1	Dec. 21	4.39	9	Dec. 4	Feb. 4
East South Central	33.9	do	8.00	9	Nov. 20	Jan. 21
West South Central	41.1	Dec. 7	7.82	8	do	Jan. 14
Mountain	34.7	Dec. 14	7.77	9	do	Jan. 21
Pacific	16.7	Jan. 11	2.45	15	do	Mar. 4
Winter 1934–35:						
All cities	5.4	Jan. 9	1.50	9	Dec. 2	Feb. 2
New England	8.1	do	3.07	7	Dec. 30	Feb. 16
Middle Atlantic	5.3	Jan. 2	1.25	9	Nov. 18	Jan. 19
East North Central	6.3	Jan. 9	1.90	7	Dec. 16	Feb. 2
West North Central	11.1	do	1.98	14	Nov. 18	Feb. 23
South Atlantic	14.5	do	3.87	10	Dec. 23	Mar. 2
East South Central	28.3	do	4.70	17	Nov. 25	Mar. 23
West South Central	10.7	Feb. 27	1.71	15	do	Mar. 9
Mountain	13.4	Jan. 30	2.86	11	do	Feb. 9
Winter 1935–36:						
All cities	12.5	Feb. 26	1.36	22	Dec. 22	May 23
New England	16.9	Jan. 1	2.24	14	do	Mar. 28
Middle Atlantic	7.1	Mar. 4	1.38	8	Feb. 9	Apr. 4
East North Central	5.7	Mar. 25	1.02	9	Mar. 15	May 16
West North Central	24.0	Mar. 18	2.84	16	Jan. 26	Do.
South Atlantic	10.7	Feb. 26	3.03	8	Feb. 2	Mar. 28
East South Central	61.1	Mar. 25	8.04	24	Dec. 1	May 16
West South Central	28.9	do	4.51	12	Feb. 16	May 9
Pacific	4.5	Mar. 4	1.28	6	Feb. 9	Mar. 21
Winter 1936–37:						
All cities	18.4	Jan. 6	3.01	11	Dec. 20	Mar. 6
New England	25.3	Feb. 10	3.64	12	Dec. 13	Do.
Middle Atlantic	11.4	Jan. 6	3.13	7	Dec. 27	Feb. 13
East North Central	16.1	do	4.07	13	Dec. 6	Mar. 6
West North Central	27.0	Jan. 20	5.95	9	Dec. 27	Feb. 27
South Atlantic	17.7	Feb. 17	2.72	16	Nov. 29	Mar. 20
East South Central	41.2	Feb. 24	7.84	15	Jan. 31	May 15
West South Central	24.5	Feb. 17	6.29	8	Jan. 17	Mar. 13
Mountain	68.0	Jan. 20	14.10	11	Dec. 13	Feb. 27
Pacific	31.0	Feb. 10	7.38	9	Jan. 3	Mar. 6
Early 1939:						
All cities	5.2	Mar. 1	1.02	9	Feb. 5	Apr. 8
New England	5.2	Apr. 5	1.57	6	Feb. 26	Do.
Middle Atlantic	2.9	Feb. 8	.98	7	Jan. 22	Mar. 11
East North Central	11.8	Mar. 1	2.55	7	Feb. 12	Apr. 1
West North Central	9.2	Mar. 8	2.09	7	Feb. 19	Apr. 8
East South Central	8.7	Mar. 22	2.13	7	Feb. 26	Apr. 15
Early 1940:						
All cities	1.9	Feb. 14	.54	6	Jan. 21	Mar. 2
West North Central	6.2	Feb. 7	1.42	8	Jan. 14	Mar. 9
South Atlantic	5.8	Jan. 31	2.42	5	Jan. 21	Feb. 24
East South Central	6.5	Feb. 14	2.57	4	Jan. 28	Do.
West South Central	13.5	Feb. 7	3.51	8	Jan. 21	Mar. 16
Winter 1940–41:						
All cities	5.4	Jan. 29	1.02	10	Dec. 15	Feb. 22
New England	12.4	Jan. 22	2.97	6	Jan. 5	Feb. 15
Middle Atlantic	4.1	Jan. 29	1.07	6	Jan. 12	Feb. 22
East North Central	1.9	do	.61	4	Jan. 19	Feb. 15
West North Central	7.2	Jan. 15	1.57	10	Dec. 22	Mar. 1
South Atlantic	5.6	Jan. 29	1.96	8	Jan. 12	Mar. 8
East South Central	15.2	Jan. 22	3.93	6	Dec. 29	Feb. 8
West South Central	13.2	Jan. 1	3.11	7	Dec. 22	Do.
Mountain	15.6	Jan. 8	4.18	6	do	Feb. 1
Pacific	8.7	Dec. 25	2.03	7	Dec. 1	Jan. 18

See footnotes at end of table.

Table 5. *Summary of period covered by epidemics and of the excess [1] mortality from influenza and pneumonia in epidemics in groups of cities [2] in the United States, 1920–51*—Continued

[illegible] of epidemic and geographic section	Total excess mortality during whole epidemic per 100,000 population [3] [4]	Date of middle (Wednesday) of peak week	Actual excess [3] per 100,000 for peak week	Total number of weeks included	Approximate dates of epidemic	
					Beginning	End
[illegible]3:						
[illegible]	0					
[illegible]nd	5.4	Apr. 14	1.53	8	Mar. 21	May 15
[illegible]est South Central	9.1	Jan. 13	1.11	16	Dec. 20	Apr. 10
[illegible]4:						
[illegible]	14.4	Dec. 29	3.78	11	Nov. 28	Feb. 12
[illegible]nd	21.9	do	6.41	14	Nov. 21	Feb. 26
[illegible]lantic	15.2	do	3.99	11	do	Feb. 5
[illegible]h Central	12.3	do	3.22	11	do	Do.
[illegible]th Central	16.9	Dec. 15	3.97	11	do	Do.
[illegible]tlantic	21.3	Dec. 29	5.27	17	do	Mar. 18
[illegible]d West South Central [4]	25.7	do	5.08	15	Nov. 28	Mar. 11
[illegible]tain	25.2	Dec. 22	5.18	16	do	Mar. 18
[illegible]acific	9.8	Jan. 5	2.59	11	Dec. 5	Feb. 19
Winter 1945–46:						
All cities	3.7	Dec. 26	1.02	11	Nov. 25	Feb. 9
New England	6.9	Jan. 9	2.49	9	Dec. 23	Feb. 23
Middle Atlantic	5.7	Jan. 2	1.25	12	Nov. 25	Feb. 16
East North Central	6.5	do	1.44	11	do	Feb. 9
West North Central	4.3	Dec. 26	1.34	8	Dec. 9	Feb. 2
South Atlantic	7.3	do	2.30	12	Dec. 2	Feb. 23
East and West South Central [4]	13.5	Jan. 2	1.80	16	Nov. 25	Mar. 16
Mountain [4]	16.9	Feb. 20	1.73	13	Dec. 2	Mar. 2
Pacific	2.9	Dec. 26	.50	12	Dec. 23	Mar. 16
Winter 1946–47:						
All cities	2.5	Mar. 26	.59	11	Feb. 16	May 3
Middle Atlantic	3.0	Apr. 9	.58	19	Dec. 22	Do.
East North Central	4.3	Mar. 26	1.34	8	Mar. 2	Apr. 26
West North Central	9.3	Mar. 12	2.07	12	Feb. 16	May 10
South Atlantic	2.6	Apr. 2	.61	8	Mar. 9	May 3
East and West South Central	7.7	do	1.09	21	Dec. 22	May 17
Mountain	9.1	Feb. 19	2.44	12	do	Mar. 15
Winter 1947–48:						
All cities	0					
East and West South Central	6.5	Feb. 25	1.78	12	Dec. 28	Mar. 20
Pacific	4.1	Jan. 14	.98	14	Dec. 14	Do.
Winter 1948–49:						
All cities	0					
East and West South Central	2.9	Feb. 2	.65	8	Dec. 26	Feb. 19
Mountain	2.6	Mar. 16	1.11	8	Mar. 13	May 7
Early 1950:						
All cities	2.7	Mar. 22	.48	9	Feb. 26	Apr. 29
Middle Atlantic	3.2	do	.65	9	do	Do.
West North Central	3.3	Mar. 29	.92	8	Feb. 19	Apr. 15
South Atlantic	3.2	do	.79	11	Feb. 12	Apr. 29
East and West South Central	3.3	do	.69	11	Feb. 19	May 6
Mountain [4]	3.2	Feb. 22	1.28	6	do	Apr. 1
Early 1951:						
All cities	3.7	Mar. 14	.65	10	Feb. 11	Apr. 21
New England	8.2	Feb. 28	2.34	8	do	Apr. 7
Middle Atlantic	5.3	do	1.21	7	do	Mar. 31
East North Central	2.2	Mar. 28	.58	7	Mar. 4	Apr. 21
South Atlantic	1.2	Dec. 6	.48	3	Nov. 26	Dec. 16
East and West South Central	3.8	Feb. 14	.67	11	Feb. 4	Apr. 21
Mountain	3.2	Oct. 25	1.30	5	Oct. 15	Nov. 18
Pacific	5.7	Mar. 14	1.05	11	Feb. 18	May 5

NOTE: Geographic sections omitted from the table had no excess mortality from influenza and pneumonia during the particular epidemic.

[1] For methods of computation, see appendix to this study.

[2] The number of cities included in the studies were approximately: 90 cities 1920–42; 56 cities 1943–51. For names of cities see appendix tables in this study and in references (*4, 5, 10*).

[3] In table 1 of reference (*4*), the peak rate for the epidemics of the winters of 1921–22, 1922–23, 1925–26, and of the spring of 1928 were computed as the average of the rates for the 3 highest consecutive weeks. In this table no such averages were used, so the peak rates are somewhat different from those in the earlier paper.

[4] In the epidemic of the winter of 1921–22, a correction was made to the base line because weeks on both sides of the epidemic were well below the median base line. For details see notes to table 1 of (*4*). A similar situation in which the base line seemed too high occurred in the East and West South Central section in the epidemics of the winters of 1943–44 and 1945–46; the excesses were measured from a parallel line 10 per 100,000 below the original base line. Similarly, a correction of 15 per 100,000 was made in the base line in the Mountain section in the epidemic of the winter of 1945–46 and of 10 in the epidemic of early 1950.

[5] See reference (*2*), table 1 for similar data on epidemics for a group of 35 large cities, 1915–19, and in Massachusetts, 1887–1915.

appears to involve nearly all of the geographic sections, but the rates in the South Atlantic and East South Central are negligible. The 1923 epidemic similarly involves most of the sections but is negligibl in the West South Central region. The smaller the epidemic t more likely it is that not every section will be involved. For exan the epidemic of 1935–36 is moderately large in the East and South Central sections but is of little importance in other s On the other hand, the epidemic of 1936–37, which was not larger than that of 1935–36, involves to some extent ever the nine geographic sections.

In the decade of the forties the epidemics are all small. already been noted that there was only one moderate epidemi whole decade, but that epidemic could have been large in one sections and negligible in others. However, every section was aL by the epidemic of 1943–44.

Because of the smaller number of cities with available data after 1942, it was necessary to combine the East and West South Central sections. In figure 8 the rates are shown for these sections separately, as far as data for the larger number of cities were available. It is seen that the situation in the two sections is rather similar, and therefore the combined picture would be expected to be fairly representative. The Mountain section also had a very small population, but its combination with the much larger population in cities of the Pacific section would have reflected nothing but the Pacific section. It therefore seemed advisable to maintain the Mountain cities as a separate unit even though the population was small.

To summarize, all geographic sections in the 1940–51 decade show the same general picture of declining excess rates in the epidemics, as compared with epidemics of earlier years.

To supplement the data shown in figures 5, 6, 7, and 8, table 5 summarizes each epidemic in each geographic section. Probably the best index of the extent of the epidemic is the total excess rate during the whole period of the epidemic. The summary table 5 shows the total excess rate (actual basis), the date (Wednesday of the peak week) of each epidemic, the excess rate (actual basis) in the peak week, the total number of weeks considered as included in the epidemic, and the date of the first day of the first week and the last day of the last week of the epidemic.

In terms of the total excess mortality credited to influenza and pneumonia, the epidemics of 1950 and 1951 were both small, 2.7 and 3.7 per 100,000 population, respectively. In the five geographic sections involved in 1950, the total excess rates varied only from 3.2 to 3.3 per 100,000. In the 1951 epidemic the total excess rates varied in the seven regions involved from 1.2 per 100,000 in the South Atlantic region to 8.2 in New England. The rates for the Pacific

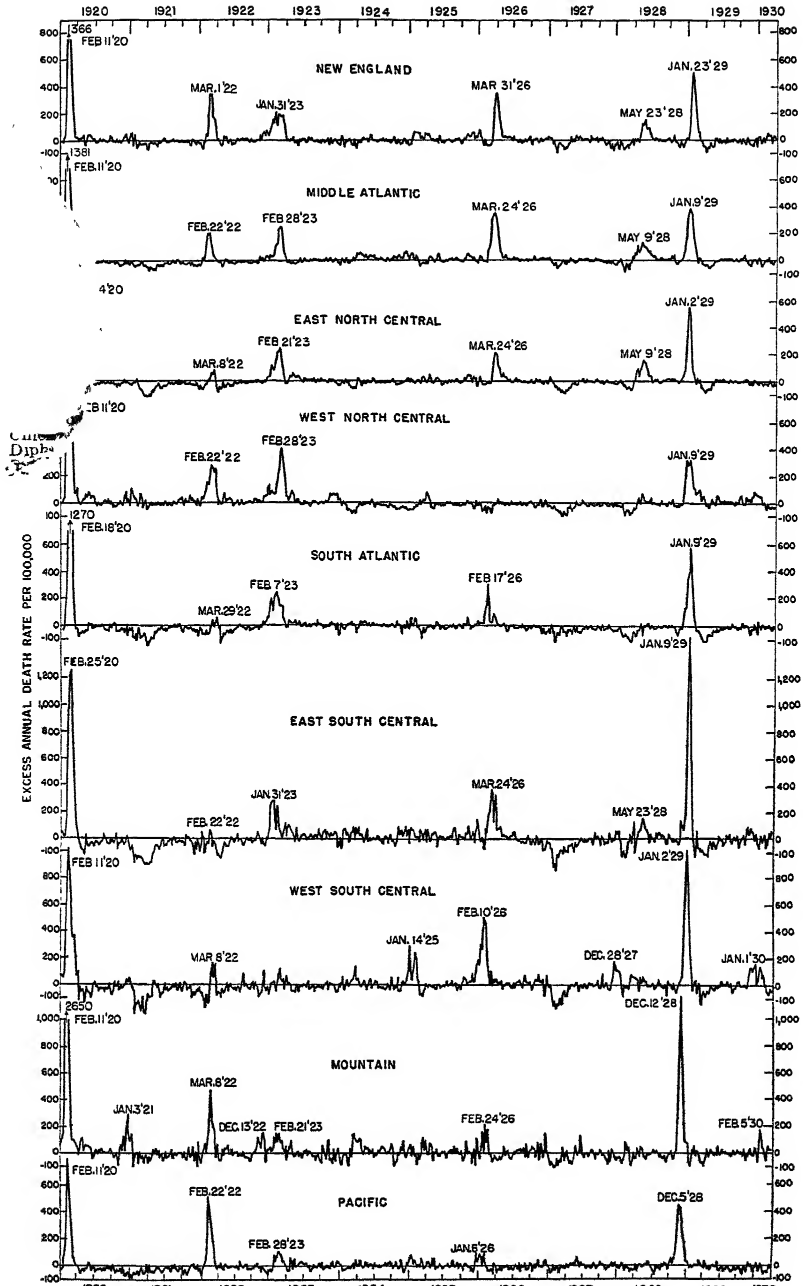

Figure 6. Weekly excess mortality (annual basis) from influenza and pneumonia in groups of cities in each geographic section, 1920–29. (See notes and references on fig. 5 for details.)

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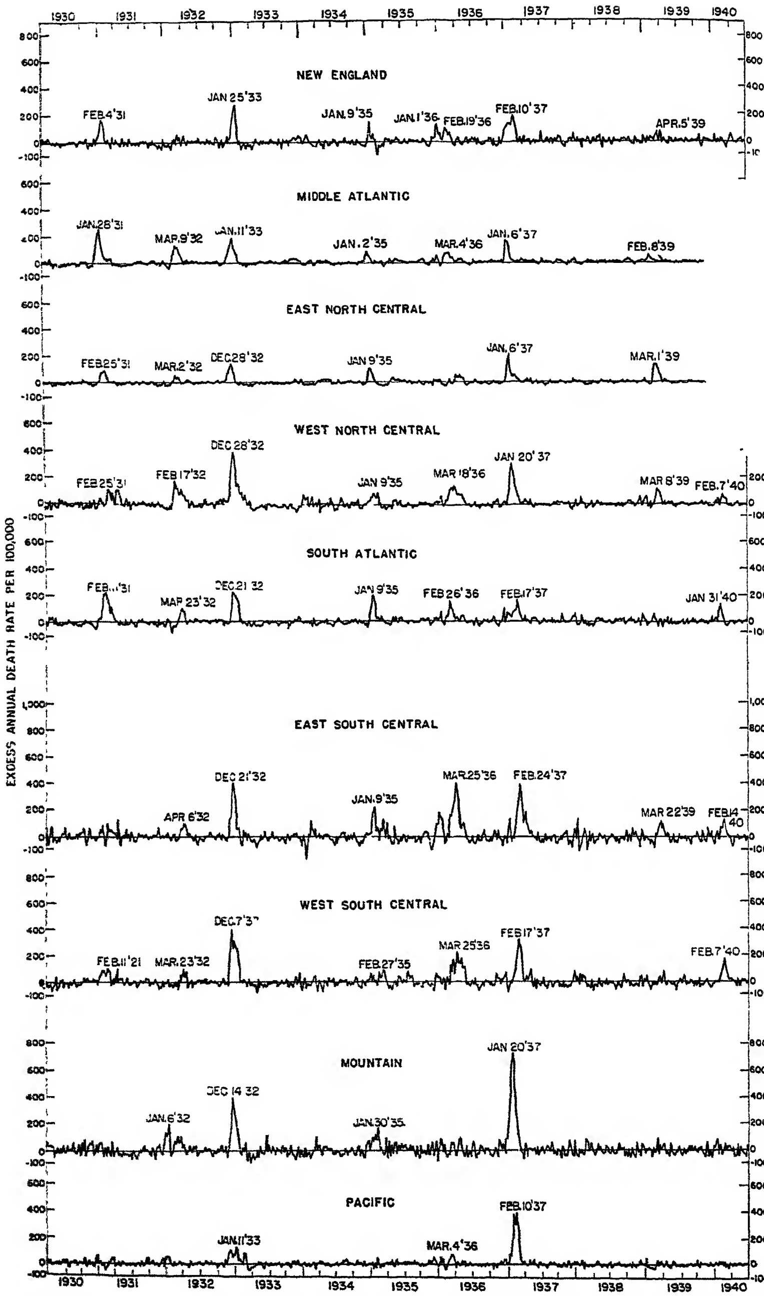

Figure 7. Weekly excess mortality (annual basis) from influenza and pneumonia in groups of cities in each geographic section, 1930–40. (See notes and references on fig. 5 for details.)

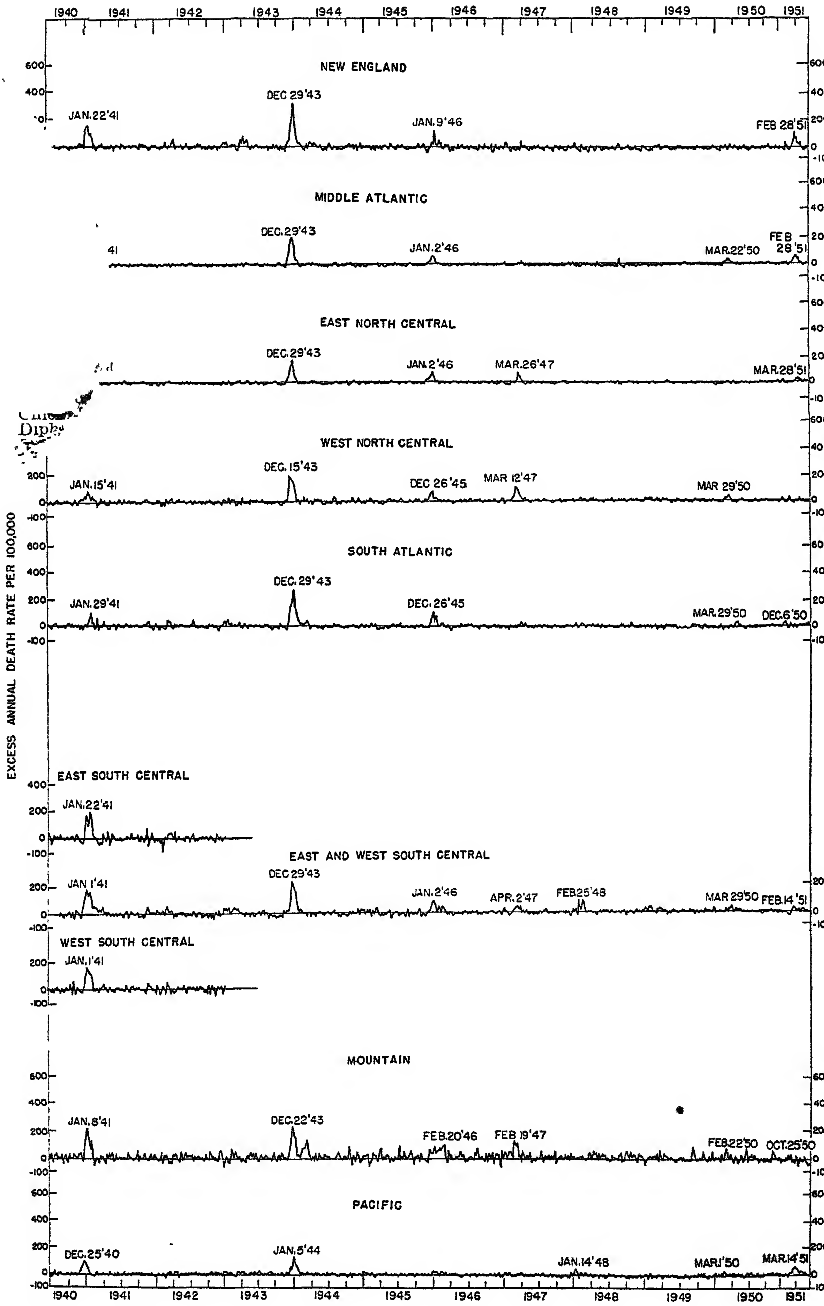

Figure 8. Weekly excess mortality (annual basis) from influenza and pneumonia in groups of cities in each geographic section, 1941–51. (See notes and references on fig. 5 for details.)

section were 5.7 per 100,000 and 5.3 for the Middle Atlantic, but only 2.2 in the East North Central region which was next to the lowest of the seven sections involved.

Summary

This study reviews the history of total annual mortality charr influenza and pneumonia and the history of epidemics as meas influenza-pneumonia mortality above normal seasonal exp The data used were weekly death rates from influenza and pn in groups of cities reporting to the Public Health Service, mented by monthly and annual death rates from the same c the registation States. No weekly mortality data are avail the total registration States.

The long-term trend of influenza and pneumonia mortality moderately downward from an annual rate of 184 per 100,000 population for 1900–1904 to about 100 for 1937. After that time the trend turned abruptly to a steeper decline until in 1950 the rate was only about 34 per 100,000. Rates in the group of cities were considerably higher than in the registration States from 1910 until the early thirties, with less downward trend; after about 1937 there was little difference in the level of the two series of rates (fig. 1).

The trend since 1920 in the cities is easily seen both in the total rates and the rates exclusive of excess epidemic rates (fig. 2).

Influenza and pneumonia rates decreased more rapidly in the first or winter quarter (January–March) of the year than in the summer quarter of July–September (fig. 3).

Aside from epidemic and other fluctuations, the generally steeper decline in influenza and pneumonia mortality after the late thirties appeared in every geographic section except the Pacific, which declined rapidly until 1947 but increased steadily in the next 4 years (fig. 4).

In terms of influenza and pneumonia deaths in excess of normal seasonal expectancy, epidemics in the decade following the pandemic of 1918 were generally larger than in the next decade. After 1937 the epidemics were distinctly smaller as measured in excess deaths from influenza and pneumonia; the only one comparable in size with the earlier periods was that of 1943–44 (fig. 5).

An examination of excess deaths in groups of cities in each geographic section indicates roughly the same developments in each region as described above for all cities combined. However, some epidemics did not affect all of the regions (figs. 6, 7, 8).

The epidemic of 1951 was the 20th outbreak of influenza and pneumonia since the pandemic of 1918–19. This count includes some epidemics with very small excess death rates but it excludes three epidemics which affected some geographic sections but did not show

an appreciable excess when cities in all regions were combined into one group.

The epidemics of 1950 and 1951 were small in total excess mortality ᴎ influenza and pneumonia, but the latter caused more mortality, ᵓularly in some geographic sections.

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ɘwes, C. H., Laidlaw, P. P., Smith, Wilson: The susceptibility of mice he viruses of human and swine influenza. Lancet 2: 859–862 (Oct. 20, 4).

s, S. D.: Influenza and pneumonia excess mortality at specific ages ıe epidemic of 1943–44 with comparative data for preceding epidemics. ɔ. Health Rep. 60: 821–835; 853–863 (1945). Reprint 2638.

ns, S. D.: Excess mortality from causes other than influenza and pneumonia during influenza epidemics. Pub. Health Rep. 47: 2159–2179 1932). Reprint 1553.

Collins, S. D.: Influenza-pneumonia mortality in a group of about 95 cities in the United States, 1920–29. Pub. Health Rep. 45: 361–406 (1930). Reprint 1355.

(5) Collins, S. D., and Gover, Mary: Influenza and pneumonia mortality in a group of about 95 cities in the United States during four minor epidemics, 1930–35, with a summary for 1920–35. Pub. Health Rep. 50: 1668–1689 (1935). Reprint 1720.

(6) Collins, S. D., Frost, W. H., Gover, M., and Sydenstricker, E.: Mortality from influenza and pneumonia in 50 large cities of the United States, 1910–29. Pub. Health Rep. 45: 2277–2328 (1930). Reprint 1415.

(7) Francis Thomas, Jr.: Epidemiology of influenza. J. A. M. A. 122: 4–7 (1943).

(8) Francis, Thomas, Jr.: Transmission of influenza by a filterable virus. Science 80: 457–458 (1934).

(9) Francis, Thomas, Jr., and Salk, Jonas E.: A simplified procedure for the concentration and purification of influenza virus. Science 96: 499–500 (1942).

(10) Gover, Mary: Influenza and pneumonia mortality in a group of 90 cities in the United States, August 1935–March 1943, with a summary for August 1920–March 1943. Pub. Health Rep. 58: 1033–1061 (1943). Reprint 2494.

(11) Heintzelman, J. H. L., Hadley, P. B., and Mellon, R. R.: Use of P-aminobenzenesulfonamide in type III pneumococcus pneumonia. Am. J. Med. Sc. 193: 759–763 (1937).

(12) Price, A. E.: Modern treatment of pneumonia. J. Michigan M. Soc. 36: 77–83 (1937).

(13) Price, Alvin E., and Myers, Gordon B.: Treatment of pneumococcic pneumonia with sulfanilamide. J. A. M. A. 122: 1021–1027 (1939).

(14) Rogers, E. S., and Gooch, M. E.: Type I pneumococcus pneumonia: Observations from a study of two thousand cases treated with specific serum. New York State J. Med. 38: 1369–1375 (1938).

(15) Shope, R. E.: The infection of ferrets with swine influenza virus. J. Exper. Med. 60: 49–61 (1934).

(16) Smith, Wilson, Andrewes, C. H., and Laidlaw, P. P.: A virus obtained from influenza patients. Lancet 2: 66–68 (July 8, 1933.)

(17) U. S. Bureau of the Census, Division of Vital Statistics: Annual Mortality Statistics, 1919. U. S. Government Printing Office, Washington, D. C., 1921, pp. 30–31.

(18) U. S. Public Health Service, National Office of Vital Statistics: Current Mortality Analysis, Dec. 1948, vol. 6, No. 12, Mar. 14, 1949; Dec. 1949, vol. 7, No. 12, Mar. 23, 1950; Dec. 1950, vol. 8, No. 12, Mar. 14, 1951.

(19) U. S. Public Health Service: A comparison of the mortality rates by weeks during the influenza epidemic of 1889–90 and during the primary stage of the influenza epidemic of 1918 in 12 cities in the United States. Pub. Health Rep. 34: 157–164 (1919). Reprint 502.

APPENDIX

The method of computing a normal seasonal curve of influenza and pneumonia mortality which was used for the years 1920–35 in the group of cities has be described in detail in earlier reports (4, 5). For the years 1920–29 the nor seasonal curve was based on median rates for each week for the 7-year p 1921–27; the 52 weekly medians were smoothed by a 5-week moving avera used for the whole 10-year period without adjustment for change in averag level of the rates. It should be noted that the use of the one norma expectancy throughout the period 1920–29 without any attempt to year-to-year differences in the level of nonepidemic rates led to a cc number of minus fluctuations during nonepidemic periods and such ex low rates as occurred in 1921, the first halves of 1922 and 1927, in Ja February of 1928, and in March and April of 1929. The closer fit of comes from the adjustment of the seasonal norm to the level of the act first by year and later by quarters.

For the years 1930–35 the normal seasonal curve was based on the mean rates for corresponding weeks in the 4 years 1930–33 with interpolated value substituted for obviously epidemic rates. The 52 weekly means of these rates were then smoothed by a 5-week moving average and used as a relative basis for seasonal expectancy. Adjustment for the change in level from year to year in the average annual influenza and pneumonia death rate was made by multiplying each of these 52 weekly rates of the normal seasonal curve by a constant; this constant was the ratio of the average of the 52 rates for a specific year (with epidemic items replaced by interpolated values) to the average of the 52 rates of the normal seasonal curve, the process being repeated for each of the nine geographic sections. The curve of normal seasonal expectancy adjusted to the level of the year in question was then subtracted from the actual rates to give weekly excess rates for each year. Although there was some downward trend in influenza and pneumonia rates from 1930 to 1935, this method gives a reasonable normal seasonal curve from which to obtain excess rates.

Some change in the method of computing a normal seasonal curve of influenza and pneumonia was made necessary by the rapid decline in the rates which has taken place since 1937. If the 52 smoothed mean rates obtained from the 3-year period 1939–42 are multiplied by a constant ratio, as was done for the years 1930–35, the derived normal seasonal curve obtained gives a very poor fit to the rates for the period 1935–37. This is due, at least in part, to the fact that influenza-pneumonia mortality during this period declined at a slower rate during the third quarter (July–September), so that the seasonal curve of influenza and pneumonia mortality had a smaller amplitude in the year 1941–42 than it had in 1935–36.

To avoid this difficulty, the level of the normal seasonal curve used in 1935–42 was adjusted quarterly instead of annually. The detailed computations were made as follows: The normal seasonal curve was based on the mean of the rates for corresponding weeks in the 3 years ended in August (32d week of year) of 1942, with interpolated values substituted for obviously epidemic rates. This period was chosen because of the small number of epidemic items and the similarity of the seasonal mortality in the 3 years. The 52 weekly values in these 3-year means of rates (with epidemic items replaced by interpolated values) were smoothed by a 5-week moving average and used as a relative basis for seasonal expectancy. Adjustment for change in level of the actual rates was made at quarterly intervals by the following procedure: The average of the actual rates (epidemic items replaced by interpolated values) for the 13 weeks of each quarter for each year was related to the average of the rates for the 13 weeks of the corresponding quarter of the normal seasonal curve to obtain a ratio of the actual to the expected rate for

each quarter of each year. Between these quarterly ratios (centering in the middle of each quarter) straight line interpolations were made to get such a ratio for each week of each year. Then the rate in the normal seasonal curve for a given week as multiplied by the above ratio for the corresponding week to obtain a seasonal ectancy for each week of each year; this process was repeated for each of the geographic sections.

n 1943–50 the procedure has been about the same as that described for , except that the years selected for use as the basis of the normal seasonal e without any apparent epidemics or at least had only very minor In applying this criterion to each of the various geographic sections, possible to use the same 3 years for every section. For all 56 cities Middle Atlantic, East North Central, Mountain, and Pacific sections, used were 1941–42, 1942-43, and 1944–45. For the New England North Central sections, 1947–48 was substituted for 1942–43 because cs in the latter year in those sections; for South Atlantic and East South Central the years used were 1944–45, 1946–47, and 1947–48. One ifference in method was that from 1943–48 final monthly influenza and monia death rates for the same 56 cities were used as the basis for computing normal seasonal expectancy. After 1948 the weekly reports from the 56 cities and the 10-percent mortality sample (*18*) were the only available data. In a few instances where the populations were small, the monthly mortality rates were adjusted by a 3-month moving average prior to the other statistical operations on the data.

It should be noted that the process of substituting obviously epidemic items with straight line interpolations is not a determining factor in the final seasonal norm: (1) Relatively few weekly rates in a year are cut off as epidemic; (2) the exact level at which the cut-off is made does not fix the level of the final seasonal norm; (3) the nonepidemic weeks in which there is no cut-off are the ones that really determine the final level of the seasonal curve and are the ones which are used as a criterion of whether the seasonal expectancy is a proper fit of the nonepidemic weekly rates.

The methods of deriving normal seasonal curves of influenza and pneumonia as outlined above are admittedly rough. Moreover, the use of quarterly ratios results in a changing yearly norm which seems to be necessary for the years during which the decline was rapid. The seasonal norms as computed, however, serve as a base from which to estimate the approximate magnitude of marked fluctuations such as occur in influenza epidemics.

Appendix tables A to I give the deviations from the seasonal expectancy for each section, together with the seasonal norms and other data necessary to derive the actual rates.

Appendix table A. *Excess [1] weekly death rates (annual basis) per 100,000 from influenza and pneumonia, 1941–51*

ALL 56 CITIES [2]

Week of year [3]	Smoothed mean [4]	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1[illegible]
1	73	+30	+5	+3	+148	+5	+50	+3	+11	−1	−[illegible]	
2	76	+31	+5	+6	+74	0	+44	+8	+6	−1		
3	77	+30	−4	+5	+35	−9	+12	+5	−5	−1		
4	77	+47	−6	+1	+20	−2	−1	−6	−9	−5		
5	77	+48	−5	+6	+1	−3	+7	−5	+4	−8		
6	77	+33	+3	−7	−1	+2	−4	−12	−4	−1		
7	77	+26	−4	−4	−2	+2	+3	−6	+2	−2		
8	76	+5	−4	+2	0	+3	−3	−3	+4	−2		
9	75	+5	+9	−4	−1	0	−4	+2	−2	−[illegible]		
10	73	+1	+11	−7	−1	−3	−9	+4	0	−[illegible]		
11	72	−4	+1	+1	+1	+1	−8	+14	−1	+[illegible]		
12	70	+2	+15	−2	+2	+1	−6	+16	−2	+6		
13	67	+5	−3	+1	+2	−5	−7	+31	−1	+8		
14	65	+4	0	−2	+1	−7	−11	+22	+1	−2		
15	62	−2	+11	+8	+6	−2	−2	+24	−5	−5		
16	60	+8	−2	−7	+2	−3	−7	+12	+1	+1		
17	57	−4	+4	+6	+4	−3	+1	+8	−1	+6		
18	54	−7	−1	+6	+2	−7	−1	0	−3	+4		
19	51	−4	0	+6	+3	−5	0	−2	+5	0	+[illegible]	
20	48	−2	−4	−5	+2	−1	−2	0	−3	−5	+1	--
21	46	−3	−2	+2	+1	+4	+2	−2	+3	−1	+1	------
22	44	0	+1	−1	−5	+6	+4	−3	−6	−2	+2	------
23	42	+2	−7	−1	−4	+4	+2	−4	−2	−1	+6	------
24	40	−5	−6	−2	−7	+1	+1	−2	−3	−1	0	------
25	39	−6	−3	+3	−5	+7	0	−4	−1	+3	+3	------
26	37	+1	−4	+9	−3	+3	+1	−4	+2	+3	+3	------
27	36	+2	−1	−6	−5	+1	−4	−1	0	+2	+2	------
28	35	−1	+4	−4	+3	+2	+2	+3	−2	−2	−1	------
29	34	−5	+8	−1	−1	−3	0	−2	+3	−1	+1	------
30	33	0	−2	+2	−4	+4	+1	−3	0	−4	−2	------
31	33	+11	−1	−4	+2	+1	+1	0	−2	+2	+1	------
32	32	+3	−4	+2	+7	−3	+1	+2	−6	+4	+1	------
33	31	−1	+1	−1	+8	−6	−2	+4	0	+8	−1	------
34	31	−4	+2	−2	0	+1	−2	+2	+2	+2	+2	------
35	32	−4	0	+3	−5	+2	0	0	+22	+1	−3	------
36	32	+1	−6	−2	−4	+6	+1	−1	+1	+2	−2	------
37	32	−1	+5	−2	−2	+4	+3	+3	+1	+2	+3	------
38	34	+2	−3	−1	0	−3	+5	+1	+1	0	+1	------
39	37	+2	−1	+1	0	−4	+1	−4	0	−1	+2	------
40	40	−5	+4	+2	−4	−1	+3	−4	−2	+5	+2	------
41	43	0	0	−3	+3	−5	+2	+2	+1	+1	+1	------
42	45	−9	−1	+1	+7	−2	−4	−3	+3	−2	+4	------
43	48	+2	0	+3	+2	+2	+1	−4	+1	−1	+3	------
44	50	+3	−5	−5	+4	−6	+1	+1	+3	+1	−1	------
45	52	+4	−3	−8	+4	−9	−1	−4	−4	−4	−2	------
46	54	+3	+1	+1	+4	−4	+6	−2	+2	+4	+2	------
47	57	+3	−1	−10	−2	−12	−5	−2	−4	−2	−3	------
48	60	+1	−7	+10	−7	−3	+1	−2	0	−1	0	------
49	63	−2	+1	+27	0	0	−5	−3	−2	−6	+2	------
50	66	−6	−1	+96	−2	+7	−5	−1	−1	−1	−4	------
51	69	−6	−3	+141	−5	+19	−6	+2	−6	−1	−5	------
52	71	−9	+16	+197	+4	+53	−2	−5	0	+5	−5	------
53	--------	−5	------	------	------	------	------	+2	------	------	------	------

QUARTERLY FACTORS FOR ADJUSTMENT OF MEANS TO CURRENT NONEPIDEMIC LEVEL

1st Q. (1–13 wk.)	1.170	1.042	1.176	1.070	0.943	0.949	0.796	0.778	0.679	0.532	0.564
2d Q. (14–26 wk.)	.988	.975	1.260	1.023	.940	.847	.861	.754	.725	.643	.727
3d Q. (27–39 wk.)	.998	1.075	1.053	1.012	.975	.854	.862	.900	.790	.643	------
4th Q. (40–52 wk.)	.913	1.141	1.112	1.011	.977	.736	.766	.720	.616	.559	------

[1] Excess over or deviation from a normal seasonal expectancy computed as outlined in the appendix. Relative seasonal expectancy was computed for years ending about the middle of August (thirty-second week of calendar year). The height of the smoothed seasonal curve was adjusted to the level of the average nonepidemic rates for each quarter.

For years prior to 1941, see corresponding tables in references (*4, 5, 10*).

[2] Enumerated population of the 56 cities in 1950 was 35,556,074 (preliminary). See list of cities in notes to tables for geographic sections.

[3] The first week of the calendar year is the calendar week that contains at least 4 days in January; thus it can be a week ending (Saturday) on any date from Jan. 4 to Jan. 10.

[4] Based on the 3 years ending in August of 1942, 1943, and 1945.

Appendix table B. *Excess [1] weekly death rates (annual basis) per 100,000 from influenza and pneumonia, 1941–51*

NEW ENGLAND CITIES [2]

Week of year [3]	Smoothed mean [4]	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951
	64	−11	−1	+44	+231	+4	+25	+9	+13	+7	+10	−2
	65	+139	+2	+24	+151	+1	+130	−11	+39	0	+1	−13
	66	+154	+2	+44	+52	−3	+23	+33	+7	−13	−8	+40
	67	+158	0	+4	+33	+5	+17	+34	+1	−17	−19	+1
	68	+78	−20	+4	+30	−5	+59	−3	−7	−21	−22	−13
	68	+80	0	+19	+19	+5	+25	−4	−28	−2	+9	−8
	69	+43	−10	+25	+9	−24	+38	−26	+24	−11	−7	+19
	68	−3	−4	+8	−9	−2	−2	−1	−10	−15	+1	+41
	66	+11	+45	+18	−21	+5	−7	−7	−11	+13	−11	+122
	66	−14	−6	−17	−7	−20	+16	−9	+10	+20	+23	+68
	65	+7	−11	−26	+25	+13	+18	−13	−16	+16	−21	+74
	63	+2	−2	+3	−5	+7	+7	−9	−31	+20	+6	+34
	62	+13	−5	+53	+36	−5	+16	+3	−11	+22	+20	+23
	60	+5	+25	+30	+38	+8	−24	−22	+16	−12	+8	+44
	58	+24	+64	+80	+29	−22	+8	+51	−1	−2	+2	−1
	56	+3	−8	+25	+5	+7	−21	+1	+13	+13	+16	−15
	54	−17	+3	+37	+26	+5	+9	+3	−26	+6	+3	+5
	51	−13	−7	+55	+19	+1	0	+20	−11	+11	0	−6
	49	+11	−5	−3	+8	−7	−8	+6	+12	+1	−14	+6
20	47	−12	−4	−1	0	−18	+22	−7	+12	−12	−9	------
21	45	+2	+16	−16	+12	+22	−10	−28	+11	−13	+15	------
22	43	+2	−25	+13	−1	+15	+5	−6	−18	−6	−10	------
23	41	−25	−12	−9	−21	+7	+13	+3	−8	+1	+12	------
24	38	−6	−11	+11	−15	+4	−9	−15	−11	−12	+16	------
25	37	+4	+19	+14	+9	−12	−7	+16	−2	+18	−10	------
26	36	+8	−15	+11	−26	−8	+5	−6	+17	−7	+13	------
27	35	+2	−15	−8	+15	+12	+9	+4	−13	+17	−16	------
28	33	−26	−12	+8	+23	+14	−11	+11	−4	−5	−8	------
29	32	+18	−13	−8	+8	+5	+6	−1	−6	+19	−4	------
30	32	+13	+1	+1	−15	+13	+6	−2	+13	−10	+6	------
31	32	+11	−6	−6	+2	+5	−1	−7	−11	+3	+2	------
32	32	−10	+4	−8	+5	−2	−3	−19	−14	+11	−5	------
33	31	−4	+21	+9	0	−2	−16	+2	+7	+3	−6	------
34	32	−3	−2	−16	−11	−16	+7	+4	+18	−10	−6	------
35	32	−9	+14	+7	−7	−11	−21	+19	+31	+13	−4	------
36	33	0	−17	−5	−8	−10	+26	−11	+10	0	−13	------
37	34	−12	−1	−8	−17	−5	+3	+4	−14	+11	+15	------
38	35	+10	+1	+21	−5	−4	+2	+8	+1	−13	+14	------
39	37	−6	−16	−8	+3	+2	−16	−28	+2	−12	−5	------
40	38	+2	+7	+16	−5	−6	+24	+10	+4	+6	+9	------
41	40	−1	−8	+13	+6	+5	+3	+15	+11	0	+6	------
42	41	−22	+25	−8	+14	+22	+3	+11	+17	+4	+28	------
43	43	+28	+12	−14	+22	+6	−10	−18	−18	0	−10	------
44	45	+14	−20	+15	+3	0	0	+11	−9	−9	−12	------
45	48	+24	+4	−13	+16	+16	+24	−2	−10	−17	−3	------
46	50	+2	+28	−3	−16	+24	−35	+3	−1	+3	−7	------
47	52	+19	+5	−25	+17	+7	−22	−20	+19	0	−6	------
48	55	−4	−14	+15	−28	−19	+31	−22	−10	−5	+13	------
49	57	−29	+13	+27	−21	−38	−7	−12	−11	−13	−5	------
50	60	−20	−2	+66	+6	−5	0	+20	−7	−12	−9	------
51	62	−34	+20	+173	+14	−1	−15	+8	−25	+12	−5	------
52	63	+14	+56	+334	−13	+40	+15	−14	+10	+14	+2	------
53	----------	−13	------	------	------	------	------	+12	------	------	------	------

QUARTERLY FACTORS FOR ADJUSTMENT OF MEANS TO CURRENT NONEPIDEMIC LEVEL

1st Q. (1–13 wk.)	1.353	1.452	1.685	1.373	1.309	1.258	1.176	1.021	1.177	0.962	0.689
2d Q. (14–26 wk.)	1.154	1.679	1.669	1.515	1.332	1.056	1.217	1.144	1.140	1.083	.663
3d Q. (27–39 wk.)	1.073	1.382	1.404	1.433	1.332	1.029	1.021	1.270	1.321	.603	-------
4th Q. (40–52 wk.)	1.312	1.849	1.502	1.455	1.335	1.184	1.102	1.026	.998	.660	-------

[1, 3] See notes 1 and 3 to appendix table A.

[2] Enumerated population of the 8 cities in 1950 was 2,018,655: Boston, 788,554; Fall River, 112,091; Springfield, 162,601; Worcester, 201,875; Providence, 254,027; Bridgeport, 158,678; Hartford, 176,623; New Haven, 164,206.

[4] Based on the 3 years ending in August of 1942, 1945, and 1948.

Appendix table C. *Excess*[1] *weekly death rates (annual basis) per 100,000 from influenza and pneumonia, 1941–51*

MIDDLE ATLANTIC CITIES[2]

Week of year[3]	Smoothed mean[4]	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	
1	64	+4	+1	−6	+156	+2	+65	+6	+28	+8	+	
2	66	+11	+6	−2	+62	−5	+57	+19	+6	0		
3	67	+19	−9	+8	+35	−13	+30	+17	−10	+3		
4	69	+46	+3	+6	+28	−5	+9	+1	−4	0		
5	70	+60	+3	+1	−2	0	+10	−4	+2	−12		
6	72	+55	+4	−7	−13	−3	+7	−7	−15	−4		
7	73	+36	−4	−5	−5	0	+5	−5	−1	−2		
8	71	+20	+2	+3	+2	+4	0	−1	+3	−2		
9	69	+3	+3	0	+2	+7	0	−2	+5	−4		
10	67	+10	+11	−11	−3	+3	−5	+9	+2	−5		
11	65	+2	0	+8	+3	+4	−2	+6	+15	−8		
12	63	+17	+15	+1	+7	+10	+4	+9	+4	+3		
13	62	+9	−9	−7	+9	−9	−3	+17	+5	+6		
14	61	+2	+3	+3	−1	−8	−10	+7	0	−3		
15	60	−8	+4	+12	+9	+7	+5	+30	−8	−8		
16	58	+14	−1	−9	+11	0	−3	+20	+5	−2		
17	55	+3	−2	+11	+3	−9	+7	+15	+5	+7	+	
18	52	−6	+4	+8	+4	−10	+4	−2	−3	0	−2	
19	49	−4	−3	+6	+5	−6	0	+3	+15	−2	+5	
20	46	−6	−2	+4	−5	0	−5	+5	−2	−3	−2	------
21	44	−11	−8	−1	+5	+1	+7	−1	−2	−1	+1	------
22	41	+3	+2	−2	−9	+4	+2	+6	−5	−1	−5	------
23	39	+5	−8	+1	−2	+5	−2	−5	−5	−2	+3	------
24	37	−1	−8	−8	−9	−1	+2	+1	0	+4	+1	------
25	35	−8	−4	+4	−8	+14	−2	−7	−3	+4	+6	------
26	34	+7	−4	+8	−5	+3	−3	+1	0	+7	+1	------
27	33	+6	+1	−5	−9	+7	−1	+2	−5	+6	+1	------
28	31	+6	+11	−5	+11	+6	+3	+6	+3	−6	−1	------
29	31	−5	+14	+2	−3	−5	+1	−4	−2	−2	+5	------
30	30	−1	−4	−7	−4	−2	−2	−2	−3	−1	−5	------
31	30	+10	−3	−1	+2	+1	+1	−2	+1	+5	−2	------
32	30	−3	−3	+4	+10	−3	+4	−2	−10	+8	0	------
33	30	+3	−2	−3	+10	−10	−5	+1	−2	+12	+1	------
34	30	−4	0	+3	+4	−3	−6	+3	−12	0	+2	------
35	30	−8	−6	−2	−9	+2	+1	−2	+45	−2	0	------
36	30	+7	−3	0	−4	+8	−1	+4	+2	0	−1	------
37	30	−4	+1	−5	+2	+5	+7	+9	+1	−4	+3	------
38	32	+3	+1	−2	−2	+3	+8	+1	−1	+2	−2	------
39	35	−1	+2	−1	−5	−2	−2	+2	−6	−2	+5	------
40	37	−4	+1	−2	−2	−1	0	−3	−2	+3	+4	------
41	40	−2	−7	+2	0	−8	+3	+5	+3	+5	+4	------
42	42	−10	−5	+8	+14	−3	−7	−5	+4	−8	+6	------
43	44	+1	+1	+10	+3	−1	+3	+1	−7	+1	+4	------
44	45	+6	−8	+1	+17	−6	0	+1	+6	+4	−2	------
45	47	+5	+7	−4	−2	−4	−4	0	−6	−2	−3	------
46	49	−3	+4	+3	+3	−1	+7	−4	+10	+3	−4	------
47	51	0	+1	−16	−11	−3	−5	−3	−6	−2	−3	------
48	54	−5	−6	+6	−4	+3	−2	+1	−3	0	−6	------
49	56	+6	−3	+34	−5	+8	−5	+7	+3	−5	+1	------
50	59	−6	0	+96	−4	+15	−1	+8	−2	−4	−5	------
51	61	+1	+5	+166	−18	+24	0	+14	−1	+2	−8	------
52	63	−5	+6	+208	+8	+63	+4	+1	−1	+1	0	------
53	----------	+4	------	------	------	------	------	+13	------	------	------	------

QUARTERLY FACTORS FOR ADJUSTMENT OF MEANS TO CURRENT NONEPIDEMIC LEVEL

1 st Q.(1–13 wk.)	1.106	1.004	1.171	1.132	0 953	0.833	0.776	0.828	0 677	0.589	0.611
2d Q.(14–26 wk.)	1.016	.849	1.350	1.098	.963	.858	.826	.838	.760	.743	.649
3d Q.(27–39 wk.)	1.058	1.082	1 043	1 056	.993	.874	.970	.909	.883	.705	-------
4th Q.(40–52 wk.)	.921	1.111	1.197	.990	.885	.769	.796	.753	.696	.581	-------

[1] [3] See notes 1 and 3 to appendix table A.

[2] Enumerated population of the 9 cities in 1950 was 12,390,642: Buffalo, 576,506; New York City, 7,841,610; Rochester, 331,292; Syracuse, 220,067; Camden, 124,474; Newark, 437,833; Trenton, 127,894; Philadelphia, 2,057,210; Pittsburgh, 673,756.

[4] Based on the 3 years ending in August of 1942, 1943, and 1945.

Appendix table D. *Excess [1] weekly death rates (annual basis) per 100,000 from influenza and pneumonia, 1941–51*

EAST NORTH CENTRAL CITIES [2]

Week of year [3]	Smoothed mean [4]	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951
	65	+20	+10	+3	+115	+6	+75	+1	−6	0	−6	0
	67	+23	+6	+7	+44	0	+49	+7	0	−1	−2	+15
	69	+7	−3	+1	+26	−9	+17	0	−2	−1	−16	−7
	68	+33	−19	0	+16	+3	+7	−12	+1	−3	−5	−7
	68	+46	−7	+12	−1	−4	+18	−8	+1	−9	−8	−8
	68	+45	+11	−11	+6	+3	−8	−13	+2	−2	−6	−1
	67	+40	−4	−16	−12	+8	+8	+11	−1	+1	−1	+1
	67	+14	−4	−1	+1	+1	+6	−1	+1	+3	−4	−8
	67	+14	+7	−15	−6	−2	+2	+12	−8	−8	+6	−1
	67	+10	+2	+9	+2	−5	−5	−1	−6	+5	+6	+5
	66	−1	+1	−4	+4	−2	−4	+13	−5	−3	+5	+16
	63	+9	+18	+4	+5	−7	0	+26	+7	+6	+12	+28
	60	0	+3	+14	0	+5	0	+70	+4	+3	+2	+30
	57	+3	+2	−7	+5	−6	−6	+48	−2	−2	+8	+17
	54	−1	+3	−6	+11	−2	0	+39	0	−7	−4	+15
	51	+12	+3	−5	−4	+1	+5	+22	−5	−2	+15	+4
	50	−4	+3	+7	+13	−1	+4	+3	+7	+9	+5	+7
	48	−2	0	+10	−1	−7	+5	−3	−5	+14	−5	+10
	46	−6	−2	+11	0	−8	0	−11	0	+1	−1	+6
20	44	−3	−5	−11	+7	−6	+2	+6	−12	−2	−7	------
21	42	+2	−11	+2	−5	+1	−2	+10	+1	−2	−3	------
22	40	+4	+8	−2	−7	+15	+11	−1	−6	−6	+6	------
23	38	+3	−8	−8	−7	−1	+6	0	−2	−5	−1	------
24	37	−1	−3	+1	−5	+4	−1	+7	0	−3	−4	------
25	34	−5	−3	+13	−5	+1	−5	0	+2	−1	0	------
26	33	−3	+1	+4	−6	+3	0	−4	+7	−1	+3	------
27	31	+3	−8	−14	−3	−6	−3	+1	+5	−1	−1	------
28	29	+2	+3	−5	+1	+4	+7	+1	−6	+1	+1	------
29	27	−1	+7	+3	+2	0	−1	+3	+11	0	−5	------
30	27	−3	−1	+2	−7	+5	0	−4	−1	−5	−3	------
31	26	+22	−2	−12	−1	+3	−2	+2	+2	−2	+7	------
32	25	+5	0	+3	+6	+1	0	+5	−7	−1	+1	------
33	25	−8	−1	−6	+11	−5	−3	−1	+1	+9	−1	------
34	25	−5	+2	+1	0	+3	−1	−2	+11	+7	−1	------
35	26	−6	−1	+2	−7	+7	+4	+2	+12	−1	−4	------
36	27	−8	−3	−2	−5	+6	−6	−6	−5	0	+4	------
37	28	−3	+8	+3	−2	+4	−3	+5	−6	+12	+3	------
38	30	−3	−7	+1	−2	−3	+2	−3	+3	+3	+4	------
39	33	+6	+3	+13	+8	−8	+6	−1	0	−3	+1	------
40	36	−10	+1	+12	−3	+2	+2	−9	0	+6	+2	------
41	38	+7	+6	−6	+13	−2	+7	−2	−2	−6	−4	------
42	41	−5	−9	−5	+7	−2	0	−3	+2	+4	−3	------
43	43	+10	−1	−1	−10	+4	−1	+1	+9	0	−6	------
44	44	+2	0	−11	−3	−3	−2	+5	0	+2	+1	------
45	46	+11	−4	−3	+2	−2	−2	−1	+2	−4	−2	------
46	48	+5	−6	−7	+12	+2	+14	+7	−4	−1	+7	------
47	50	−3	0	+5	0	−7	−9	+6	−3	−4	−2	------
48	53	0	−3	+14	−2	+14	−2	+3	+1	0	+1	------
49	55	−2	+1	+34	+4	+23	−11	−4	−5	−6	+2	------
50	57	−11	+4	+90	−14	+31	−3	−4	−2	+2	+1	------
51	59	−6	−8	+126	−5	+44	−3	−1	−1	−1	−4	------
52	62	−14	+20	+168	+3	+62	+5	+3	−1	0	−3	------
53	----------	−1	------	------	------	------	------	−3	------	------	------	------

QUARTERLY FACTORS FOR ADJUSTMENT OF MEANS TO CURRENT NONEPIDEMIC LEVEL

1st Q. (1–13 wk.)	0.970	0.973	1.091	0.899	0.913	0.789	0.732	0.701	0.748	0.526	0.578
2d Q. (14–26 wk.)	.954	.893	1.096	.891	.909	.937	.838	.708	.745	.670	.821
3d Q. (27–39 wk.)	.919	.980	.933	.916	.985	.817	.827	.983	.855	.673	-------
4th Q. (40–52 wk.)	.857	1.046	1.019	.941	.835	.731	.794	.829	.564	.558	-------

[1] [3] See notes 1 and 3 to appendix table A.

[2] Enumerated population of the 11 cities in 1950 was 8,896,816: Cincinnati, 499,744; Cleveland, 909,546; Columbus, 373,821; Fort Wayne, 132,831; Indianapolis, 424,683; South Bend, 115,402; Chicago, 3,631,835; Detroit, 1,837,617; Flint, 162,752; Grand Rapids, 175,647; Milwaukee, 632,938.

[4] Based on the 3 years ending in August of 1942, 1943, and 1945.

Appendix table E. *Excess [1] weekly death rates (annual basis) per 100,000 from influenza and pneumonia, 1941–51*

WEST NORTH CENTRAL CITIES [2]

Week of year [3]	Smoothed mean [4]	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	
1	74	+69	−4	+23	+149	+8	+70	+16	+17	−19		
2	75	+55	+27	+22	+102	−4	+14	+17	−19	−5		
3	76	+80	+15	0	+20	−25	+26	+2	−1	+19		
4	75	+87	+6	−3	−13	−6	+16	−22	+1	−5		
5	75	+41	−23	+34	+12	+9	−3	+2	−12	+27		
6	74	+48	−28	−18	−25	−4	0	−6	+18	+6		
7	74	+64	+5	+23	+12	+21	+11	−5	+19	+20		
8	72	+28	−29	+14	−2	+14	−17	0	−11	−4		
9	71	+48	+17	+12	+28	+1	+5	+15	+8	+3		
10	69	−20	+7	−27	−7	−11	+9	+40	+6	−2		
11	68	+5	−10	−32	+10	+10	−1	+108	−9	+13		
12	65	+6	+13	+9	+22	+10	−8	+98	−10	−4		
13	63	+43	+15	−12	−12	−14	+23	+82	−6	+20		
14	61	+33	+9	−21	+12	−20	0	+53	+18	−2		
15	59	+21	+11	+30	−3	−7	−8	+37	+2	−13		
16	57	+26	+3	−14	−18	−32	−9	+23	+18	+15		
17	55	−8	+13	+4	−11	−10	−19	+3	−4	+4	[illegible]	
18	52	−3	+15	−9	+18	−3	−10	+23	−8	0	−4	
19	50	−1	−1	+4	+4	−6	−2	+1	+10	+11	−7	[illegible]
20	48	+25	−10	−26	+18	+15	−3	−1	−12	−5	+6	------
21	47	+8	0	+19	+4	+18	−2	+2	−1	−2	0	------
22	45	−10	+2	−6	+15	+16	+8	−24	0	−12	+8	------
23	44	−5	0	+12	−8	0	+11	+11	−5	−11	+16	------
24	43	−1	−18	+12	−16	+16	+1	−5	−20	+8	−4	------
25	42	−9	−12	−15	−14	+8	+14	−8	+1	−5	+3	------
26	41	+2	−5	+18	+10	+7	+11	+1	−5	+18	+1	------
27	40	+7	+9	+1	−6	−8	−11	+7	+10	+12	−4	------
28	39	+8	+7	+9	−7	−4	0	+8	−8	+3	−5	------
29	39	−11	−23	+6	−5	+7	+11	+1	+19	−4	−4	------
30	39	+10	+9	+22	−10	+22	+19	−9	+1	−6	−5	------
31	38	+8	+13	−6	−7	−4	−1	+1	−13	+1	+6	------
32	38	+2	−9	−5	+25	−7	−9	+18	−1	−7	+11	------
33	38	0	−3	−4	+4	−6	+10	+16	−5	+13	−2	------
34	38	−2	+3	−5	−18	−7	−3	0	+3	−5	−5	------
35	39	−13	+10	−6	+3	−10	+5	−4	+11	−9	−5	------
36	39	0	−12	−1	−9	+13	+1	−6	−9	+1	−5	------
37	40	−3	+10	−14	−14	+4	+9	0	+8	−5	+6	------
38	41	+7	−13	−8	+4	−10	−6	−5	−10	0	0	------
39	43	−7	−13	−8	+5	−13	−15	−18	+9	+9	−1	------
40	44	−15	+12	+6	+3	−1	−2	+1	+4	+14	+4	------
41	46	−7	−3	+1	−4	+13	+5	+6	−13	+4	+13	------
42	48	−9	+18	+13	−4	+2	−5	−4	−2	+2	−4	------
43	51	−14	+20	−8	+10	+14	+7	0	−2	−17	+4	------
44	54	+5	−1	−19	+1	−2	+2	+16	+16	−5	−4	------
45	57	+5	−7	−25	−4	−10	−2	−11	−10	+5	−4	------
46	60	+17	−11	+8	+28	+2	−4	−17	0	+8	−5	------
47	62	−2	−1	−19	+6	−15	−7	+3	−8	−10	−5	------
48	64	+5	−18	+21	−13	+19	+19	−19	+14	−3	+2	------
49	67	−2	+11	+7	0	−4	0	+9	−2	−5	+2	------
50	69	−1	−15	+207	+22	+2	−12	−1	+3	+6	−11	------
51	71	−10	−19	+185	+9	+24	−18	−3	−13	−11	+12	------
52	72	−12	−10	+176	−27	+70	+2	0	+4	+8	0	------
53	------	−2	------	------	------	------	------	−2	------	------	------	------

QUARTERLY FACTORS FOR ADJUSTMENT OF MEANS TO CURRENT NONEPIDEMIC LEVEL

1st Q. (1–13 wk.)	1.085	1.065	1.519	1.461	1.341	1.147	1.002	0.905	0.797	0.672	0.567
2d Q. (14–26 wk.)	.970	1.118	1.442	1.388	1.209	1.074	1.071	.873	.841	.813	.861
3d Q. (27–39 wk.)	.998	1.072	1.217	1.106	1.025	1.088	1.063	.929	.805	.585	------
4th Q. (40–52 wk.)	.916	1.212	1.333	1.370	1.199	.957	.922	.802	.702	.587	------

[1] [3] See notes 1 and 3 to appendix table A.
[2] Enumerated population of the 7 cities in 1950 was 2,650,215: Duluth, 104,066; Minneapolis, 517,410; St. Paul, 310,155; Kansas City, Mo., 453,290; St. Louis, 852,523; Omaha, 247,397; Wichita, 165,374.
[4] Based on the 3 years ending in August of 1942, 1945, and 1948.

Appendix table F. *Excess [1] weekly death rates (annual basis) per 100,000 from influenza and pneumonia, 1941–51*

SOUTH ATLANTIC CITIES [2]

Week of year [3]	Smoothed mean [4]	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951
[illegible]	66	+49	+29	+6	+144	−8	+33	−3	+17	−12	−15	+12
[illegible]	67	+11	+6	+35	+90	+12	+77	−13	+20	+10	−20	+1
[illegible]	68	+54	+9	+49	+47	+6	+12	+4	−13	−7	−6	−5
[illegible]	68	+71	+4	+7	+46	+2	+3	−24	+3	+8	−2	+8
[illegible]	68	+120	+17	+26	+4	−8	−1	+9	+10	−20	−5	−1
[illegible]	68	+42	+9	+9	+22	+24	+13	−6	+25	−5	−7	−8
[illegible]	68	+52	+20	+7	+2	+4	+24	0	+15	−3	+4	−5
[illegible]	67	+10	−1	+8	+29	+1	+13	−10	+3	+6	+13	−2
[illegible]	65	+38	+11	+4	−1	+16	−5	+7	−15	−6	+3	+10
[illegible]	63	+101	+60	+14	+45	−10	−12	−21	+6	−23	+6	+1
[illegible]	62	+29	+60	+32	+13	−26	+14	+21	+7	+19	+19	+8
[illegible]	59	+12	+56	−4	0	−18	−15	+5	+5	+6	+37	+4
[illegible]	56	+38	+6	−11	−13	−10	−35	+30	+3	+8	+41	+14
[illegible]	53	+19	+2	+4	+3	−6	−15	+32	+15	−2	+5	+15
[illegible]	50	+53	+30	+27	+1	−15	−4	−2	+9	0	+24	+28
[illegible]	47	+6	0	+3	+1	+3	−6	+13	−5	+14	+13	0
[illegible]	45	+25	+11	−19	+6	−5	−8	+23	−4	+1	−2	−6
[illegible]	43	−26	−4	+6	−14	−15	−4	+10	+16	+13	−3	−7
[illegible]	40	−16	0	+8	−8	+1	+3	−12	−4	0	−16	−3
20	38	−4	−12	0	−1	−1	−12	−8	−15	−19	−2	------
21	36	+7	−4	+2	+1	+1	+20	−3	+12	0	−2	------
22	33	+12	−11	−1	−15	+17	+9	−12	−10	−8	+7	------
23	30	+11	−5	+5	+8	+13	−7	−17	−5	+7	+5	------
24	28	−24	−7	+3	+9	−3	+10	+7	−9	−8	+5	------
25	27	0	0	0	+8	+19	+9	−7	+2	+7	−1	------
26	27	+6	−1	+13	−5	+1	+14	−6	+8	+4	+4	------
27	26	+6	+24	−12	+4	+25	+2	+5	−4	−4	+2	------
28	26	−2	+4	−1	−4	−4	0	+8	+1	−4	−3	------
29	26	−1	+40	−5	−6	−6	+17	−4	−6	−4	+3	------
30	27	−17	−6	+15	+23	+2	+4	−1	−2	−2	−9	------
31	27	+3	−7	+2	+1	+3	−9	+7	−5	+12	+1	------
32	28	+26	−4	+15	−4	+5	−2	+5	0	+5	+5	------
33	28	+6	−5	+9	+10	−9	−8	−6	−8	+11	−4	------
34	29	−13	−2	−12	+14	−9	−19	+4	+3	−4	−2	------
35	30	+4	−1	−3	−11	−4	−9	−1	+13	+12	+4	------
36	31	−15	−11	−24	−1	+6	+7	−7	+5	−5	−6	------
37	31	−3	−8	−6	−11	−7	+9	−12	+17	−1	+4	------
38	32	−4	−7	+1	−14	−12	+4	−4	−12	−12	−3	------
39	33	−8	−15	−12	−5	+13	+12	+5	+8	0	+12	------
40	34	−4	+46	+4	−17	+6	+6	+1	+3	+22	−5	------
41	35	−12	+6	−29	+5	−1	−13	+6	−5	+6	+9	------
42	36	−10	+10	+15	+3	+4	−8	+7	+8	−5	0	------
43	39	−13	+16	+10	−1	+14	−2	−7	+23	−9	+5	------
44	42	+3	+5	−9	+4	+13	+1	+3	0	+1	−6	------
45	45	+4	0	+4	+11	−5	−8	−12	−6	+1	−3	------
46	48	+2	+2	−6	−8	+1	+11	−8	−6	+2	−7	------
47	51	+11	−3	−23	−8	−6	−8	+6	−10	−13	−1	------
48	54	+33	−19	+23	−16	+1	−1	+3	+2	+4	+24	------
49	57	−8	−7	+61	−9	−3	+6	−1	−8	−4	+25	------
50	60	−2	+26	+139	+27	+28	−5	+3	−6	−10	+12	------
51	62	−13	+41	+169	+11	+58	−10	−1	−4	−9	−17	------
52	64	−24	+80	+275	+7	+120	+9	−8	+10	+15	−13	------
53	----------	−12	------	------	------	------	------	+5	------	------	------	------

QUARTERLY FACTORS FOR ADJUSTMENT OF MEANS TO CURRENT NONEPIDEMIC LEVEL

1st Q. (1–13 wk.)	1.539	1.585	1.603	1.424	1.283	0.995	0.972	0.836	0.768	0.671	0.744
2d Q. (14–26 wk.)	1.835	1.612	1.964	1.321	1.354	1.075	1.128	.986	.873	.755	.734
3d Q. (27–39 wk.)	1.398	1.671	1.460	1.301	1.273	1.030	.996	1.021	.854	.640	-------
4th Q. (40–52 wk.)	1.395	1.694	1.647	1.351	1.142	.855	.904	.860	.744	.527	-------

[1] [3] See notes 1 and 3 to appendix table A.
[2] Enumerated population of the 6 cities in 1950 was 2,522,946: District of Columbia, 792,234; Atlanta, 326,962; Baltimore, 939,865; Richmond, 229,905; Tampa, 124,073; Wilmington, 109,907.
[4] Based on the 3 years ending in August of 1945, 1947, and 1948.

Appendix table G. *Excess* [1] *weekly death rates (annual basis) per 100,000 from influenza and pneumonia, 1941–51*

EAST AND WEST SOUTH CENTRAL CITIES [2]

Week of year [3]	Smoothed mean [4]	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	
1	71	+187	+43	+38	+238	+33	+94	+14	+29	+14	—	
2	73	+171	+18	+58	+182	+5	+84	+36	+9	+25		
3	75	+132	+15	+25	+98	+3	+22	+19	+43	+19		
4	75	+164	+6	+52	+47	+28	+24	+10	−25	+9		
5	75	+122	+18	+5	+27	0	+61	−4	+80	+34		
6	75	+52	+34	+19	+42	+29	+8	−22	+19	+34		
7	75	+69	+1	+25	+31	−23	+27	−4	+19	−1		
8	73	+50	+39	+46	+6	+21	+48	+7	+93	−5		
9	70	+48	+65	+41	+17	−8	+46	+22	+17	0		
10	68	+22	+53	+33	−6	+15	+22	+31	+15	−9		
11	65	+46	+13	+41	−14	+42	−12	+54	−1	+17		
12	63	+17	+28	+12	+13	−3	+1	+55	+2	+21		
13	60	+34	+4	+18	+15	−6	−10	+27	−6	+30		
14	57	+58	−25	+7	−16	−12	+15	+57	+5	+21		
15	54	+8	+17	+8	+9	−7	−2	+5	−15	+15		
16	51	+23	−22	−5	+4	−14	−25	+10	−2	−3		
17	48	−17	+9	+10	−22	+1	+3	+26	−6	+12	[illegible]	
18	45	+13	0	0	+6	−4	−10	+2	−12	−14	+5	
19	42	−8	+13	+11	−2	+4	+1	+27	−9	+2	+14	
20	38	−4	−7	−21	+13	+6	−6	−4	+8	−7	+2	------
21	37	+7	+22	+18	+12	+21	+4	−8	+14	+9	−12	------
22	36	−10	+1	+11	+5	−21	−7	−2	−7	+10	+1	------
23	35	+11	−18	−13	−8	+13	+7	−3	+14	−2	−5	------
24	34	−4	+20	−3	−10	+4	+4	−9	+12	+1	0	------
25	33	−6	−4	−1	+8	+20	+13	0	+4	−6	+3	------
26	33	−8	+5	+6	+12	+13	+9	−9	+8	−2	−8	------
27	33	+4	−3	+24	0	−10	−13	−13	0	0	−5	------
28	32	−12	+6	−5	−4	−3	−11	+4	−3	+6	+1	------
29	32	−20	+24	+17	+11	−4	−15	+6	+9	+10	+2	------
30	33	+10	+7	+33	+4	+12	+2	−8	+9	+4	+2	------
31	33	+27	+1	+1	+28	−1	+17	+4	−7	+5	0	------
32	34	+5	−11	+12	+2	−12	+2	+16	−3	−6	+12	------
33	35	−17	+13	+11	−1	−6	+5	+27	+1	−3	+3	------
34	35	−7	+8	−29	−14	+22	+15	+1	−1	+10	+15	------
35	36	+20	+7	+8	−9	−10	−12	−6	−11	+6	−11	------
36	37	+5	−23	−1	−15	+1	−6	−8	−3	+3	−14	------
37	38	−1	+2	−19	−10	+12	−11	−7	−1	−14	−9	------
38	39	0	−10	−6	+3	−6	+13	−5	+6	−14	+1	------
39	40	−3	+3	−9	−1	−5	+9	−10	+6	+4	−13	------
40	41	+16	−32	−29	−12	−10	+6	−10	−25	−14	+6	------
41	42	−13	−3	−12	−7	−1	−1	+1	+7	−1	−9	------
42	44	−15	+1	−13	−4	+18	−4	−2	+1	+4	+15	------
43	46	−14	−31	−6	+22	+37	+2	−12	−2	−2	+17	------
44	49	−6	+3	−13	−8	−4	+2	+2	+16	−14	−7	------
45	51	−24	−31	−24	+21	−20	+10	−2	−12	−7	+9	------
46	54	+20	+24	+25	+4	−6	−6	+1	−7	+13	+9	------
47	57	+58	+9	−3	+3	−16	−3	−9	−5	+7	−11	------
48	59	+10	+10	+31	−3	−2	−3	+20	+10	−2	−7	------
49	62	+11	+36	+23	+45	+5	−2	−9	−9	+6	−5	------
50	65	+12	−6	+54	−3	+15	+12	−3	+8	−5	0	------
51	67	+14	−2	+131	+39	+27	+1	−24	−7	−1	−9	------
52	69	+5	+55	+265	+27	+71	−25	−11	+14	+27	−5	------
53	------	−1	------	------	------	------	------	+14	------	------	------	------

QUARTERLY FACTORS FOR ADJUSTMENT OF MEANS TO CURRENT NONEPIDEMIC LEVEL

1st Q. (1–13 wk.)	1.383	1.409	1.275	1.389	1.283	1.215	1.057	1.133	0.729	0.579	0.643
2d Q. (14–26 wk.)	1.560	1.605	1.693	1.522	1.480	1.327	1.406	1.143	.772	.719	.692
3d Q. (27–39 wk.)	1.646	1.665	1.856	1.532	1.324	1.381	1.230	.914	.728	.500	------
4th Q. (40–52 wk.)	1.542	1.331	1 417	1 651	1.327	1.136	1.027	.702	.527	.605	------

[1] [3] See notes 1 and 3 to appendix table A.
[2] Enumerated population of the 7 cities in 1950 was 2,866,916: Birmingham, 298,747; Dallas, 432,805; Houston, 593,600; Memphis, 394,025; Nashville, 173,359; San Antonio, 405,973; New Orleans, 568,407.
[4] Based on the 3 years ending in August of 1945, 1947, and 1948.

Appendix table H. *Excess [1] weekly death rates (annual basis) per 100,000 from influenza and pneumonia, 1941–51*

MOUNTAIN CITIES [2]

Week of year [3]	Smoothed mean [4]	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951
	73	+273	−14	+5	+149	+11	+81	+35	−13	−30	−11	+12
	75	+231	+6	−39	+57	+18	+39	+23	−3	−5	−5	−8
	76	+114	−15	−41	+16	+16	+47	+1	−3	−5	+1	+24
	75	+96	+8	−9	+18	−63	+67	+39	−2	−4	−35	+6
	74	+131	−53	+65	0	−42	+48	+39	−1	+5	+25	+31
	73	−48	+44	+46	+63	−22	+68	+10	+10	−3	−20	−21
	71	−13	+14	+6	+65	+29	+88	0	−7	+7	−21	−30
	71	+9	+23	+39	+65	+10	+90	+127	−17	−18	+67	−6
	71	−22	−22	0	+126	+12	−16	+90	−9	+28	+32	+35
	71	−43	−13	−9	+15	−27	−43	+101	−10	−25	−3	−52
	71	+11	−47	+14	+15	−26	+46	+7	+26	+58	−3	+23
	69	+14	−26	−33	−23	+58	+1	+11	+26	+15	+25	−2
	66	+17	+28	−7	−20	+63	+16	−33	−19	0	−9	−18
	63	−2	+8	−23	+3	−22	−19	+48	+46	−15	−33	+34
	61	−31	+20	−39	−25	+2	−15	+23	+28	+33	+4	+26
	59	+3	−22	−4	+28	−5	−12	−12	+38	+17	+14	−25
	58	−18	−2	+9	−22	+17	0	+9	−27	+10	−21	−34
	57	+48	−34	−9	−11	+19	−2	+11	+28	+2	−29	−35
	56	+17	+39	+34	+31	−39	+4	−6	0	−5	+15	−18
	55	+40	−14	+6	+2	−27	+45	+34	+9	+5	−19	------
21	55	−25	+41	+28	−8	−8	+6	−33	+18	−3	−9	------
22	55	−25	+44	−11	−18	−29	+25	−23	+9	−29	+1	------
23	54	+8	+5	+32	+13	0	−23	−13	+19	−10	+81	------
24	54	−14	+7	+3	+4	−10	−14	−23	−27	−9	−23	------
25	52	−13	+1	−35	+6	−19	−32	−2	−8	−7	+14	------
26	51	−23	−7	+9	−4	+80	−3	−11	−26	+3	+24	------
27	49	−21	−2	+13	−11	−17	0	−9	−24	−23	+35	------
28	47	−10	−19	−15	−9	+4	+1	+50	+5	+15	+1	------
29	46	−8	−5	−2	−7	−5	−17	−25	−4	−11	+29	------
30	44	−8	−13	+11	−6	+46	−26	−5	−3	−19	+4	------
31	43	−17	+1	+13	−4	+7	+33	+6	−11	−9	+6	------
32	41	+48	−7	−16	+7	−12	+5	−3	−19	−16	−19	------
33	40	+17	−4	−13	+39	−1	+65	+8	+18	−6	−9	------
34	41	+5	+5	−4	+8	+10	−13	+19	+37	−15	−10	------
35	41	−7	−8	−16	−14	+51	−4	−19	−29	+21	+8	------
36	41	−18	−21	−7	−15	+12	+6	+11	−20	+83	−19	------
37	41	−19	+19	+32	−6	−47	−33	−17	−21	−15	−19	------
38	43	−22	−6	−22	+12	+2	−25	+50	+24	+2	−3	------
39	46	+39	−21	−26	−12	0	+22	−38	+41	−17	−22	------
40	48	−28	+37	+11	−6	+18	−39	−19	+29	−17	−14	------
41	50	+11	+63	+18	+82	−34	+28	−10	−1	0	−25	------
42	53	−3	−38	−18	+17	+14	−4	−1	+43	−10	+18	------
43	56	−8	−2	+29	−59	+32	−7	+8	+3	+52	+68	------
44	59	−2	−20	−8	−13	0	+39	−12	+19	−3	+58	------
45	63	+15	−17	−4	+12	−12	−42	−13	+6	−22	+21	------
46	67	−12	−47	0	−35	−24	+23	+16	−34	−23	+1	------
47	67	−33	−5	−20	+45	−35	+22	−13	−7	+2	−9	------
48	67	+21	+16	+12	+4	−46	+20	+17	+21	−9	+15	------
49	68	+33	+57	+64	−38	+53	−30	−21	+12	−28	−21	------
50	68	+1	+57	+209	−29	+32	−71	+27	+11	+42	+4	------
51	69	+22	−40	+270	+10	+30	+44	−1	−36	−23	−16	------
52	71	+21	−11	+166	+17	+37	−18	−2	−56	+1	−19	------
53	----------	−1	------	------	------	------	------	+8	------	------	------	------

QUARTERLY FACTORS FOR ADJUSTMENT OF MEANS TO CURRENT NONEPIDEMIC LEVEL

1st Q. (1–13 wk.)	0.934	0.984	1.508	1.084	1.409	1.226	1.203	0.492	0.780	0.667	0.781
2d Q. (14–26 wk.)	.839	1.403	1.205	1.071	1.215	.951	.947	.677	.554	.661	1.107
3d Q. (27–39 wk.)	.916	.880	.845	1.045	1.503	1.059	.988	.692	.383	.452	-------
4th Q. (40–52 wk.)	1.148	1.491	1.237	1.283	1.103	.970	.630	.794	.345	.511	-------

[1] [3] See notes 1 and 3 to appendix table A.
[2] Enumerated population of the 2 cities in 1950 was 594,725: Denver, 412,823; Salt Lake City, 181,902.
[4] Based on the 3 years ending in August of 1942, 1943, and 1945.

Appendix table I. *Excess* [1] *weekly death rates (annual basis) per 100,000 from influenza and pneumonia, 1941–51*

PACIFIC CITIES [2]

Week of year [3]	Smoothed mean [4]	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	
1	73	+94	+4	+18	+135	+15	+17	+4	+20	+7	—	
2	74	+49	+13	+10	+78	+17	+21	+13	+51	+13	+	
3	75	+36	+7	−5	+48	+12	+16	−8	+14	−3		
4	76	+3	0	−9	+20	−5	−4	+5	−18	−12		
5	76	+1	−4	+8	+10	+1	+6	+8	+16	+4		
6	76	+1	−4	+3	+5	−7	+22	+1	+20	+14		
7	76	−4	−4	−11	+8	+11	+17	−8	+15	−5		
8	75	−1	−14	−12	−2	−8	+8	−5	+8	−[illegible]		
9	73	+18	+1	−12	−5	−18	+15	−7	+21	−4		
10	72	−1	+12	−9	+10	+3	+7	−2	+18	−10		
11	71	−5	+12	+14	+3	−7	−1	+3	−3	+10		
12	69	−2	+18	−5	+2	+4	+4	−3	+1	+5		
13	68	−6	−1	+4	+2	−7	+1	+11	+6	+4		
14	67	+11	−8	+11	−2	0	+6	+10	−11	−5		
15	66	−6	+17	−15	−10	+3	+7	+2	−4	−10		
16	64	−3	+11	−10	+6	0	+2	−10	+2	−6		
17	62	+3	+18	−3	+7	+10	+11	+4	0	−1		
18	60	−10	−24	−11	−4	−3	−10	−1	+2	+2	−[illegible]	
19	58	+11	0	0	+11	−1	+5	+3	−4	−1	+1	
20	56	+4	+4	+5	−5	+1	−11	−6	+8	−5	+4	------
21	54	−7	+6	−1	−10	−3	−13	−1	+4	+1	−12	------
22	53	−12	−3	−5	−3	−9	−11	−1	−4	+9	−2	------
23	51	+1	+3	+17	+3	+3	−2	−6	+1	+10	−1	------
24	49	−13	−13	0	−9	−4	+2	−6	−13	−4	−16	------
25	47	+6	0	+6	−10	−3	+4	+2	−9	+12	−8	------
26	45	−4	−12	+23	+12	−9	+1	0	−4	−3	+3	------
27	43	0	+4	+3	−6	−4	−9	+2	+17	−7	+16	------
28	41	−1	+9	+2	+3	+6	+9	−2	+9	+4	+1	------
29	39	+3	+2	−11	+9	+1	0	+3	+4	−3	+3	------
30	38	+12	+5	−2	0	−2	+8	+6	+8	−4	+14	------
31	37	−5	+7	+1	+7	+4	+4	−1	−3	−6	−9	------
32	36	−3	−10	−9	−4	−6	+2	−4	0	+15	−4	------
33	36	+2	−6	−4	−3	−1	−10	+1	+1	−2	−5	------
34	36	−9	−4	0	−7	+8	−4	−4	+2	+4	+6	------
35	36	−7	−6	+16	+7	+5	+6	−1	0	−8	−10	------
36	37	+3	−11	−2	−4	+5	−4	+5	+7	−1	−4	------
37	38	+6	+2	−3	+2	+8	0	−4	+2	−1	+4	------
38	39	−3	−10	−12	+1	−10	+3	+4	+3	0	−4	------
39	40	+10	+2	+3	−9	−6	−3	−3	−9	−5	+8	------
40	42	−6	+1	−4	−11	+7	0	+2	−10	+7	−6	------
41	44	+7	+11	+1	−8	0	−7	−6	+7	−5	+2	------
42	46	−5	+15	−4	−5	−1	+2	0	−11	+15	+5	------
43	49	+11	−13	+9	+13	−1	+5	−8	+3	0	+6	------
44	52	−3	+5	+2	−14	+5	+1	−9	−8	+9	+7	------
45	55	−12	−4	−10	+9	−1	0	−4	−3	−5	−10	------
46	58	−2	+3	+7	0	+4	+13	+1	+2	+16	+15	------
47	60	−8	−5	+10	0	−2	+9	+9	−3	+4	0	------
48	63	−6	+4	−3	−1	−4	−6	−3	−8	−10	−2	------
49	65	−14	−7	−4	+7	+2	+7	−8	+4	−20	+3	------
50	67	+9	+5	+62	+9	−8	−11	−13	+8	+2	−22	------
51	69	−6	−9	+37	−12	−2	−8	+27	−4	−1	+9	------
52	71	−2	+4	+106	+20	+26	−10	−5	−3	−6	−8	------
53	----------	−12	------	------	------	------	------	+3	------	------	------	------

QUARTERLY FACTORS FOR ADJUSTMENT OF MEANS TO CURRENT NONEPIDEMIC LEVEL

1st Q. (1–13 wk.)	0.613	0.945	0.935	0.770	0.644	0.519	0.414	0.401	0.664	0.695	0.701
2d Q. (14–26 wk.)	.538	.877	.924	.638	.523	.436	.349	.404	.587	.701	.777
3d Q. (27–39 wk.)	.679	.800	.683	.631	.563	.418	.390	.809	.510	.845	-------
4th Q. (40–52 wk.)	.675	.989	.705	.671	.522	.385	.346	.580	.658	.747	-------

[1], [3] See notes 1 and 3 to appendix table A.

[2] Enumerated population of the 6 cities in 1950 was 3,615,159: Seattle, 462,981; Spokane, 160,473; Tacoma, 142,975; Los Angeles, 1,954,036; Sacramento, 134,313; San Francisco, 760,381.

[4] Based on the 3 years ending in August of 1942, 1943, and 1945.

Incidence of Disease

th department, State or local, can effectively prevent or control disease without nowledge of when, where, and under what conditions cases are occurring

UNITED STATES

orts From States for Week Ended October 27, 1951

eria incidence and mortality have shown a steady decline in few decades, and, like typhoid fever, the very marked seasonal in incidence has almost disappeared. The incidence has decreased more slowly in the Southern States (South Atlantic, East South Central, and West South Central) than in other parts of the United States. In 1930, 33 percent of the total cases reported in the United States occurred in the South although in the past 3 years, 1948–50, 54 percent of the total were reported by these States and since July 1 of the current year, 62 percent.

The peak incidence of diphtheria in the United States usually has been reached in October or November. During the period when a much larger proportion of cases was being reported from the northern part of the country, the peak for the country as a whole was reached in November. The larger proportion of cases reported from the Southern States in recent years has caused the peak to be reached in October, since the seasonal occurrence of the disease begins earlier in the South. For the current year, all of the seasonal upswing in the number of cases has been accounted for by cases from the South. For the 4 weeks ended July 28, the average weekly number of cases reported was 21 for the three groups of Southern States, 19 for the remainder of the country. For the 4 weeks ended October 20, the average was 95 for the Southern States and only 20 for all other parts of the United States. For the current week there was a total of 141 cases of which 112 were reported in the three groups of Southern States.

Epidemiological Reports

Eastern Equine Encephalomyelitis Infection in Pheasants

Dr. J. C. Hart, Connecticut Department of Health, has reported that on October 19, 1951, word was received from the Department of Animal Diseases, College of Agriculture of the University of Connecticut, that encephalitis was present in pheasants on two widely separated pheasant farms. On one farm about 65 out of 200 pheasants had died from the disease and on the other about 15 were ill out

of a total of 2,500 on the farm. Preliminary virus neutralization tests on strains isolated from one farm indicated that the etiological agent is eastern equine encephalomyelitis virus. Follow-up studi are being continued at the University of Connecticut and in ot laboratories to verify the findings. Pheasants from these two f are under quarantine. Should the strain of virus be verif eastern equine encephalomyelitis, it will be the first time it h identified in the northeastern part of the country since 1938 serious epidemic occurred in human beings and horses in M setts. During that year, 29 horses were ill with encep Connecticut and the virus was isolated from a pheasant fr necticut. There have never been any human cases, however, in this State. This year there have been no cases of illn gesting sleeping sickness in horses and only one reported c encephalitis in humans. This was a 66-year-old woman reporteu in March 1951. The type of encephalitis in this patient is unknown. The neighboring State departments of health have been notified of the existence of this infection in Connecticut.

Trachoma

Dr. R. W. Williams, Office of Indian Affairs, reports that 88 cases of conjunctivitis were found during routine physical examinations of children in the Pipestone Indian School, Minnesota. These are thought to be mild cases of trachoma that are being treated as such pending further investigation.

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Oct. 27, 1951	Oct. 28, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	-------	1	1	(1)	(1)	(1)	(1)	49	40	43
Diphtheria (055)	141	150	327	27th	1,211	1,706	3,051	3,219	4,834	7,661
Encephalitis, acute infectious (082)	23	32	16	(1)	(1)	(1)	(1)	886	816	543
Influenza (480–483)	365	615	615	30th	4,014	6,144	6,144	120,069	144,908	133,260
Measles (085)	2,003	1,201	1,190	35th	9,295	5,805	5,767	478,206	293,976	560,009
Meningitis, meningococcal (057.0)	84	69	66	37th	358	367	325	3,419	3,166	2,932
Pneumonia (490–493)	605	1,011	(2)	(1)	(1)	(1)	(1)	51,047	68,752	(2)
Poliomyelitis, acute (080)	903	1,314	830	11th	23,544	26,688	23,068	24,756	27,819	23,418
Rocky Mountain spotted fever (104)	4	1	1	(1)	(1)	(1)	(1)	318	445	535
Scarlet fever (050)[3]	811	961	1,152	32d	4,859	5,315	6,850	58,245	45,485	63,246
Smallpox (084)	1	-------	-------	35th	1	1	3	12	27	51
Tularemia (059)	4	14	14	(1)	(1)	(1)	(1)	551	767	807
Typhoid and paratyphoid fever (040,041)[4]	66	83	73	11th	2,212	2,471	2,849	2,647	2,980	3,334
Whooping cough (056)	1,109	1,543	1,543	39th	3,783	5,909	3,909	57,558	103,104	82,058

[1] Not computed.
[2] Data not available.
[3] Including cases reported as streptococcal sore throat.
[4] Including cases reported as salmonellosis.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Oct. 27, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057 0)	Pneumonia (490–493)	Poliomyelitis (080)
d States	**141**	**23**	**365**	**2,003**	**84**	**605**	**903**
nd	**5**		**2**	**294**		**42**	**12**
			2	48		6	
mpshire				32		8	
				32			
usetts	5			132			3
sland				10		1	
ticut				40		27	9
tlantic	**9**	**5**	**3**	**618**	**14**	**68**	**87**
York	5	4	(1)	270	6		47
w Jersey		1	3	109	1	29	11
Pennsylvania	4			239	7	39	29
East North Central	**6**	**1**	**6**	**363**	**22**	**60**	**221**
Ohio	1			78	3		41
Indiana	3		3	10		3	17
Illinois	1		3	131	9	45	67
Michigan	1	1		66	5	12	39
Wisconsin				78	5		57
West North Central	**4**		**6**	**25**	**5**	**37**	**96**
Minnesota	1		2	5	2	16	25
Iowa				1	2		8
Missouri	1			2			18
North Dakota			2	7		7	1
South Dakota			1	1		1	1
Nebraska				3			9
Kansas	2		1	6	1	13	34
South Atlantic	**55**	**2**	**19**	**185**	**12**	**91**	**71**
Delaware							
Maryland		1		88		18	15
District of Columbia	1			14		10	1
Virginia	15	1		31	2	52	8
West Virginia	3			13			22
North Carolina	18			16	6		6
South Carolina	9		2	4	1	4	2
Georgia	9		17	16	2	7	10
Florida				3	1		7
East South Central	**36**	**7**	**2**	**220**	**12**	**28**	**71**
Kentucky	12			182	2		10
Tennessee	1	2		7	1		16
Alabama	20	4		11	8	15	19
Mississippi	3	1	2	20	1	13	26
West South Central	**21**	**3**	**99**	**24**	**8**	**191**	**107**
Arkansas	5		87	1		20	14
Louisiana	3	1	1	2	1	14	20
Oklahoma			11	2		9	17
Texas	13	2		19	7	148	56
Mountain	**3**		**158**	**132**	**1**	**44**	**67**
Montana			2	35			5
Idaho				6			4
Wyoming				1		3	9
Colorado			11	12	1	8	8
New Mexico	1		4	38		23	3
Arizona	2		141	7		10	5
Utah				33			31
Nevada							2
Pacific	**2**	**5**	**70**	**142**	**10**	**44**	**171**
Washington			56	23	2	1	16
Oregon			5	20	1	18	15
California	2	5	9	99	7	25	140
Alaska							
Hawaii	1		57	195			1

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Oct. 27, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040,041)	Whooping cough (056)	Rab ar
United States	4	811	1	4	66	1,109	
New England		40			5	142	
Maine					2	19	
New Hampshire		1				19	
Vermont		1				16	
Massachusetts		29			3	75	
Rhode Island		1					
Connecticut		8				13	
Middle Atlantic		120			4	220	
New York		60			1	99	
New Jersey		23				47	
Pennsylvania		37			3	74	14
East North Central		200		1	8	224	8
Ohio		62			3	34	2
Indiana		19			1	31	5
Illinois		22		1	3	48	
Michigan		66			1	62	
Wisconsin		31				49	1
West North Central		48			4	32	22
Minnesota		1			1	1	15
Iowa		9				13	6
Missouri		18			1	8	1
North Dakota		4			1	1	
South Dakota		1			1		
Nebraska		1					
Kansas		14				9	
South Atlantic	1	139		1	7	89	13
Delaware		4					
Maryland		13				5	
District of Columbia		13				3	
Virginia		15			3	21	1
West Virginia		6			1	30	1
North Carolina	1	60		1	1	12	
South Carolina		10			1	1	6
Georgia		14			1	10	5
Florida		4				7	
East South Central	1	76		1	7	99	31
Kentucky		25			2	39	13
Tennessee		38		1	1	36	7
Alabama	1	8			2	21	8
Mississippi		5			2	3	3
West South Central		20		1	11	172	29
Arkansas		3			6	26	2
Louisiana		3				5	
Oklahoma		5				10	2
Texas		9		1	5	131	25
Mountain	1	34	1		5	69	
Montana		6			1	13	
Idaho		12				4	
Wyoming			1			1	
Colorado		2			1	11	
New Mexico		1			2	28	
Arizona		3			1	12	
Utah	1	10					
Nevada							
Pacific	1	134			15	62	
Washington		23			2		
Oregon		13			2	3	
California	1	98			11	59	
Alaska							
Hawaii					1		

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended October 13, 1951

...ase	Total	New-foundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
...is	6					2	3				1
...pox	375	8				36	132	16	39	71	73
...eria	5					5					
Dysentery, bacillary	10					4	2				4
Encephalitis, infectious	4					2	1		1		
German measles	106			2		4	11		17	20	52
Influenza	12			3			3	1			5
Measles	466	6		33	2	26	44	7	9	262	77
Meningitis, meningococcal	7	3				2	1				1
Mumps	195	8				22	80	12	28	8	37
Poliomyelitis	62			2	6	13	32	1	3	2	3
Scarlet fever	220				2	50	37	30	14	37	50
Tuberculosis (all forms)	196	22		3	1	74	25	24	4	19	24
Typhoid and paratyphoid fever	19				2	7				10	
Venereal diseases:											
Gonorrhea	260	7		8	8	76	40	21	16	42	42
Syphilis	77	4		5	6	34	7	2	3	5	11
Primary	6			1	1	3	1				
Secondary	5			1		1	1			1	1
Other	66	4		3	5	30	5	2	3	4	10
Whooping cough	176	4		2		57	37	15	28	25	8

CUBA

Reported Cases of Certain Diseases—5 Weeks Ended September 29, 1951

Disease	Total	Pinar del Rio	Habana		Matanzas	Santa Clara	Camaguey	Oriente
			Habana City	Total				
Cancer	118	4		14	22	30	19	29
Chickenpox	2							2
Diphtheria	17		2	6	8			3
Leprosy	1		1	1				
Malaria	132			1			4	127
Measles	42		20	26	9			7
Poliomyelitis	1							1
Tuberculosis	84	2	4	6	21	23	18	14
Typhoid fever	78	14	7	15	4	19	12	14
Whooping cough	1			1				

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yello fever are published currently.

Cholera

India. The incidence of cholera has been decreasing in M since the week ended September 22, when 181 cases were reporte the week ended October 20, there were 26 cases reported. In C however, the incidence has increased from 33 cases to 66 dur period.

Smallpox

Cameroon (British). Three cases of smallpox were reported week ended September 1, one of which was reported in Victoria.

French Equatorial Africa. During the period October 1–10, cases of smallpox were reported.

Indochina. For the week ended October 20, 24 cases of smallpox were reported in Hanoi, Viet Nam; and two cases were reported in Haiphong.

Pakistan. During the week ended October 20, smallpox was reported in ports of Pakistan as follows: Lahore, three cases, and Chittagong, one.

Spain. One case of smallpox was reported in Spain for the week ended September 8.

Typhus Fever

Germany (French Sector). During the period September 2–29, nine cases of typhus fever were reported in the French Sector of Berlin.

Puerto Rico. Two cases of murine typhus fever were reported in San Juan for the week ended September 29.

Yellow Fever

Venezuela. A fatal case of jungle yellow fever was reported on September 29 in La Frontera in the region of Tumeremo, Bolívar State.

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Dise nting f the of this publication has been approved by the Director of the Budget (August 10, 1949).

PUBLIC HEALTH REPORTS, first published in 1878 under authority of an Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON D. C. : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
Price 15 cents. Subscription price, $4.75 a year; $6.25 foreign.

Public Health Reports

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Complex Fluorides: Caries Reduction and Fluorine Retention in the Bones and Teeth of White Rats

By I. Zipkin and F. J. McClure*

This study was made to obtain data on the physiological availability and effects of fluorine as it occurs in several complex chemical combinations. The criteria for evaluation of these fluorides (as administered by injection and in drinking water of growing rats) were (1) deposition of fluorine in bones and teeth, (2) development of incisor striations and, (3) ability to inhibit experimental rat caries. These and similar experiments not only help to elucidate the metabolism of fluorine but may also have a practical application to fluoridation of drinking water, which has become an effective procedure for the partial control of human dental caries. Although sodium fluoride (NaF) is now the most common fluoride in use for community water fluoridation, other compounds, particularly sodium fluosilicate (Na_2SiF_6), if found comparable to NaF in physiological effects, may have an advantage in being produced at less expense than NaF.[1]

In a previous publication (*1*) the junior author reviewed earlier reports of the effects of a number of different fluorides (NaF, Na_2SiF_6, Na_3AlF_6, $BaSiF_6$, NH_4F, KF, K_2SiF_6, and CaF_2) and reported that NaF and Na_2SiF_6, when ingested in drinking water by growing rats in amounts which furnished 5, 10, 15, 25, and 50 ppm of fluorine, resulted in equivalent retentions of fluorine in the bones and teeth, mandibles, and femurs, and produced similar incisor striations. In general, this study (*1*) indicated that fluorine in NaF and Na_2SiF_6 is equally available.

Deposition of fluorine in dental and skeletal tissues of hamsters receiving Na_3AlF_6, Na_2PO_3F, KPF_6, NaF, and "Flural"[2] (*2*) was also recently reported. Less fluorine was retained in the lower incisors of hamsters receiving "Flural", KPF_6, and Na_3AlF_6, than in hamsters

*National Institute of Dental Research, Bethesda, Md.

[1] Since commercial grade NaF is 95 percent pure, and at current market quotations (*21*) sells for 11¢ per lb., and commercial Na_2SiF_6 is 98 percent pure and sells for 5¢ per lb., the cost per lb. of available fluorine is now approximately three times more for NaF than for Na_2SiF_6.

[2] Flural is a commercial preparation of the Ozark-Mahoning Company, Tulsa, Okla., containing alum and a fluoride. One commercial grade has a composition approximating the formula $AlFSO_4 \cdot 2H_2O$ (*6*).

receiving NaF, but fluorine retained in the tibias was proportional to the fluorine ingested, regardless of the type of fluoride fed (*2*).

Data on the biological availability of covalent-bonded fluorine are very meager. Kempf et al. (*3*, *4*) reported that α-fluoronaphthalene produced mottled enamel, whereas p, p-difluorodiphenyl, p-fluorobenzoic acid and fluorobenzene had no such effect. No tissue analyses for fluorine were reported. Boyer et al. (*5*) did not find any increase of fluorine in the bones of rats fed 0.004 percent 3-fluorotyrosine in the diet; in fact, less fluorine was found than in control rats receiving no fluoride. Euler and Eichler (*7*), however, reported that 2 mg./kg. of 3-fluorotyrosine given by stomach tube produced mottling in rat incisors and histological changes in the bones and teeth. No tissue analyses for fluorine were reported. Armstrong et al. (*8*) recently have reported "bleaching of the teeth" and the presence of inorganic fluoride in the urine of rats receiving 4-fluorophenylalanine by mouth. Hagan et al. (*9*) have also presented evidence that sodium monofluoroacetate may be metabolized by the rat, since only 22 percent of the sodium monofluoroacetate fed could be recovered in the carcass and excreta as the parent compound.

One significant criterion of the physiological availability of different fluorine compounds is their effect on experimental animal caries. Comparable evidence is somewhat meager in this regard, since the majority of caries inhibition studies relate to the effects of sodium fluoride. Keyes and Shourie (*10*) reported that 50 ppm fluorine as sodium fluoride "was very effective in reducing caries activity in the molar teeth of hamsters, sodium fluosilicate was somewhat less effective, and calcium fluoride was essentially ineffective." More recently, the acute toxicity and ability to inhibit caries in hamsters were used as criteria for a comparison of NaF and Na_2PO_3F (*11*). Comparable caries reduction was attributed to Na_2PO_3F and NaF when administered in the drinking fluid at a level of 40 ppm F. However, on the basis of fluorine content, the complex fluoride Na_2PO_3F appeared to be 2.5 to 3.0 times less toxic than NaF (*11*). In further studies, this group of workers reported that Na_3AlF_6, "Flural", Na_2PO_3F, and NaF had "nearly maximal" inhibitory effects on hamster caries, but that KPF_6 did not reduce caries significantly (*2*).

It is generally true that the majority of the fluorine compounds studied up to this time, when ingested at levels just sufficient to produce characteristic striation in rats' incisor teeth, have similar effects. At higher intakes, differences in physiological effects generally have been attributed to different solubilities which seemingly affect absorption from the digestive tract. Aside from the factors of solubility and concentration, however, fluorine in some chemical compounds, even though adequately soluble and absorbed from the digestive tract may not be metabolized. Such fluorides would not be expected

to show characteristic effects of the fluoride ion per se, and would not deposit fluorine in body tissues. Thus, Boyer et al. (*5*), as noted above, reported that no fluoride could be found in rats fed 3-fluorotyrosine in the diet. Two inorganic fluorides, Al_2F_6 (*3*, *4*) and ZnF_2 (*3*), have also been reported not to produce incisor striations when fed in the diet at a concentration of 0.10 percent F. From our experiments reported below, it now appears that two other fluorides, KPF_6 and CF_3COONa, although highly soluble, do not produce characteristic fluorine effects and cause no deposition of fluorine in body tissues.

Experimental

One hundred and fifty female white rats of the Holtzman strain, 21–27 days of age, representing 30 litters of 5 rats each, were equally distributed into 5 groups. An additional 180 males of the Holtzman strain, 21–27 days of age, representing 30 litters of 6 rats each, were distributed equally into 6 groups. All rats received, *ad libitum*, a cariogenic diet of the following composition:

	Percent
Whole milk powder	30. 0
Yellow corn grits	42. 0
Cane sugar, granulated	25. 0
Whole dried liver substance (Wilson)	2. 0
Salt mixture	1. 0

Salt mixture	*Gram*
Sodium chloride	400
Potassium chloride	400
Magnesium carbonate	100
Iron and ammonium citrate	20
Manganous sulfate	28
Calcium hydrogen phosphate	50
Cupric acetate	2

The plan of the experiment was as follows:

Group	*Number rats*	*Sex*	*Fluid*	*Route of administration*
Control	30	F	Distilled water	Peroral.
Drink B	30	F	50 ppm F as Na_2SiF_6	Peroral.
Inject B	30	F	500 ppm F as Na_2SiF_6	I. P.
Drink C	30	F	50 ppm F as Na_2PO_3F	Peroral.
Inject C	30	F	500 ppm F as Na_2PO_3F	I. P.
Control	30	M	Distilled water	Peroral.
Drink D	30	M	50 ppm F as KPF_6	Peroral.
Inject D	30	M	500 ppm F as KPF_6	I. P.
Drink E	30	M	50 ppm F as NaF	Peroral.
Inject E	30	M	500 ppm F as NaF	I. P.
Drink FF	30 ·	M	50 ppm F as CF_3COONa	Peroral.

All groups received approximately the same quantity of fluorine, except the rats receiving Na_2SiF_6 injected intraperitoneally. Injected rats received 3.5 mg. fluorine weekly, distributed over five daily injections. Because of its high acidity (pH 3.3), the inject Na_2SiF_6 solution was poorly tolerated; for this reason these rats received less fluoride, since the study was terminated when all the rats had been on the cariogenic diet the same length of time. The diet contained

1.3 ppm F, which was considered negligible in calculating the total fluorine consumption.

At the end of 91 days, the animals were killed and the teeth diagnosed for dental caries according to Cox et al. (*12*). The femurs, mandibles, molars, and incisor teeth were dried, extracted with alcohol and ether and ground to pass a 60-mesh sieve. The incisors and molars were separated into dentin and enamel by the Manly-Hodge technique (*13*). All tissues were then ashed at 550° C. for 3 hours and analyzed for total fluoride (*14*).

Analysis of Fluorine Compounds

The preparation of the fluoride solutions required a careful assay for purity and for free fluorine in KPF_6, Na_2PO_3F, and CF_3COONa, which were commercial grade samples. NaF and Na_2SiF_6, being analytical grade reagents, were accepted according to specifications. Na_2PO_3F was found to contain 13.5 percent total fluorine (*14*) (13.2 percent theory), and 1.85 percent free fluorine (*15*), indicating that 13.7 percent of the total fluorine was present as free fluorine. This commercial product specified a purity of 90–97 percent with NaF, $(NaPO_3)_x$, and Na_2CO_3 as impurities.[3] By repeated shaking of solutions of this commercial Na_2PO_3F with MgO, free fluorine was reduced to 7.0 percent of the total fluorine. This purified Na_2PO_3F solution was used to prepare the rats' drinking and injection solutions.

KPF_6 contained no free fluorine (*16*) and averaged 94.6 percent purity by the Willard and Winter fluorine analysis (*14*) and 98.6 percent purity by the PbClF precipitation procedure (*17*). Similarly, no free fluorine was found in CF_3COONa. However, analysis of CF_3COONa for total fluorine by the usual Willard and Winter perchloric acid distillation was unsatisfactory, no fluorine being detected in the distillate by $Th(NO_3)_4$ titration. Ashing of CF_3COONa for 3 hours at 550° C. in the presence of CaO gave only 65.9 percent recovery of theoretical fluorine. Further analysis of CF_3COONa by fusion with Na_2CO_3 followed by precipitation as PbClF (*17*) gave 92.0 percent of theoretical fluorine. The most satisfactory analysis was obtained by fusing 95.4 mg. CF_3COONa, 15 gm. Na_2O_2, and 0.4 gm. sucrose in the Parr bomb, dissolving the fused mixture in hot water, neutralizing with HCl, and diluting to 2 liters with distilled water. This solution when titrated for fluorine with $Th(NO_3)_4$ gave 98.0 percent of theoretical recovery, which agrees well with the reported assay of 98–99 percent.[4]

Results of Experiments

Without exception all the fluorine compounds, when injected, caused

[3] Ozark-Mahoning Co., FP Compounds. Tulsa, Okla., 1949.
[4] Hooker Electrochemical Co., Niagara Falls, N. Y. Preliminary Technical Data Sheet No. 377.

no reduction in dental caries (see table). Though this negative result cannot be explained by the absence of fluorine in the molar dentin and enamel of these rats, it is nonetheless possible that fluorine as acquired by these teeth from parenterally administered fluoride did not reach the oral enamel surface in sufficient time perhaps, or in sufficient quantity, to exert a cariostatic effect. It will be noted that the quantity of fluorine in molar enamel of injected rats is consistently lower than the fluorine in the molar enamel of rats receiving fluorides orally. This negative effect of injected fluoride agrees with previous results with rats (*18*) and, to some extent, with previous results with hamsters (*10*). Although hamster caries appeared to be inhibited by injected fluoride, it was suggested that fluorine may have reached the oral cavity via coprophagy.

Also, no caries inhibition occurred with orally administered KPF_6, which agrees with a previous hamster study (*2*), nor from oral CF_3COONa. The absence of any increased fluorine in the teeth of these rats and the lack of enamel striations are consistent with this observation. Reduction of caries was similar in the three groups of rats given NaF, Na_2SiF_6, and Na_2PO_3F in their drinking water. The teeth of these rats responded also by a greatly increased fluorine content in the enamel and dentin. The caries reducing effect of NaF has been repeatedly demonstrated (*19*), and the caries inhibiting effect of Na_2SiF_6 was anticipated by evidence of the availability of its fluorine (*1*). As previously mentioned, other studies (*11*) have also shown the ability of Na_2PO_3F to reduce caries in hamsters. Reduction in the percent of rats having caries, i. e., the reduced incidence of caries, was 21.3, 19.4, and 15.7 percent, respectively, for NaF, Na_2SiF_6, and Na_2PO_3F. Severity of caries as indicated by the caries score was reduced 39.2 percent by NaF, 45.0 percent by Na_2SiF_6, and 45.0 percent by Na_2PO_3F. These three fluorides, therefore, were essentially similar in their cariostatic effects.

As shown in the table, two groups of rats, one male, the other female, served as controls. Since differences in caries between these two groups were not statistically significant, they were combined to give a composite control group which was used as the standard of reference. This result thus contributes to the evidence that sex is probably not a factor in the production of rat caries.

The complex fluorides KPF_6 and CF_3COONa were strikingly different from the other fluorides in the physiological availability of their fluorine. No fluorine was deposited in the bones and teeth of rats ingesting these compounds. The data are graphically presented on the chart.

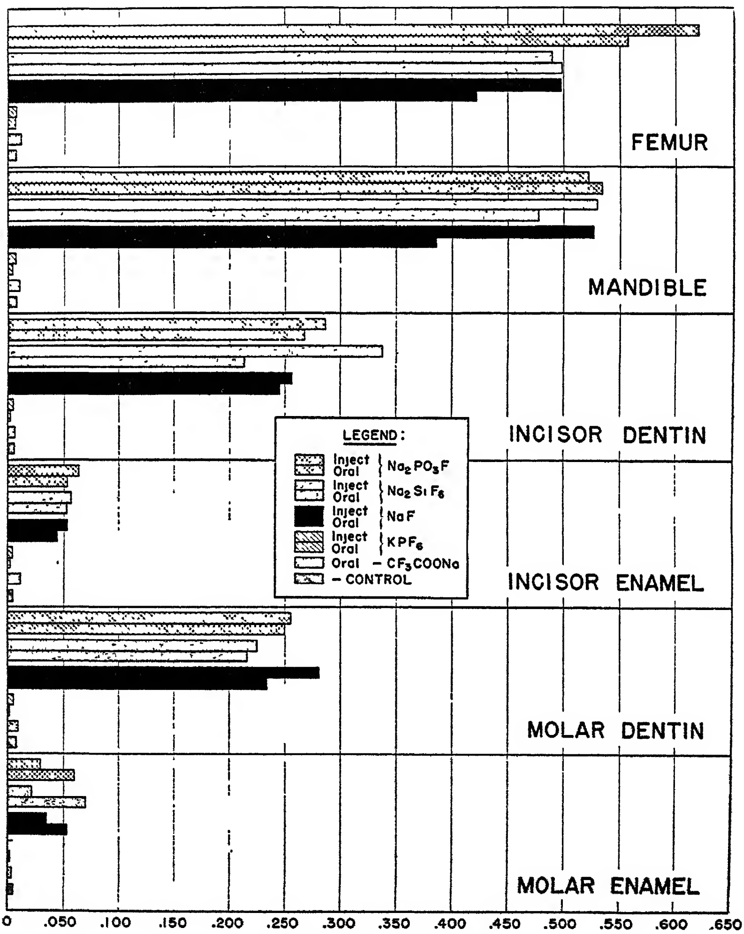
Owing to difficulties in the fluorine analysis of CF_3COONa, some uncertainty arose as to the failure to find fluorine in bones and teeth of rats receiving this compound. The remote possibility existed that

Metabolism and caries inhibitory effects of fluorine in different chemical combinations

Item	Control	Control	Control	NaF oral	NaF inj.	Na_2SiF_6 oral	Na_2SiF_6 inj.	Na_2PO_3F oral	Na_2PO_3F inj.	KPF_6 oral	KPF_6 inj.	CF_3COONa oral
	Male	*Female*	*Both*	*Male*	*Male*	*Female*	*Female*	*Female*	*Female*	*Male*	*Male*	*Male*
Total fluorine (mg.)	0.0	0.0	0.0	62.6	60 5	59.5	46.7	61.2	57.2	64.2	60.6	63.0
Days on experiment	92	92	92	91	91	91	91	91	92	91	91	91
Final weight (gm.)	260	187	222	275	247	195	178	187	189	280	255	275
Initial weight (gm.)	35	35	35	33	35	36	38	36	37	35	35	34
Average daily gain (gm.)	2.4	1.7	2.0	2.7	2.3	1.7	1 5	1.7	1.7	2.7	2.4	2 6
	Caries diagnosis											
Number of rats	27	30	57	29	23	27	29	27	27	27	26	27
Number of litters	27	30	57	29	23	27	29	27	27	27	26	27
Rats with caries (number)	27	28	55	22	23	21	28	22	25	26	26	26
Rats with caries (percent)	100 0	93 3	96.5	75 9	100.0	77.8	96.6	81.5	92.6	96.3	100.0	96 3
Carious teeth per carious rat (number)	4.1	3.5	3.9	3.6	4.7	2.8	3.9	3.0	4.0	4.4	4.3	4.2
Carious teeth per carious rat (percent)	34.2	29.2	32 5	30.0	39.2	23.3	32.5	25.0	33.3	36.7	35.8	35 0
Carious areas per carious rat (number)	6.5	5.3	5.9	3.7	7.3	3.2	6.5	3.4	5.7	7.2	8.0	6.4
Caries score per carious rat	13.2	10.8	12.0	7.3	15.0	6.6	14.6	6.6	13.4	15.4	17.7	13.8
	Fluorine analysis of teeth and bones (ash basis)											
Molar enamel (percent)	0.005	----------	[1](0.005)	0.053	0.036	0.071	0.022	0.059	0.029	0.001	----------	0 003
Molar dentin (percent)	.004	0.011	(.008)	.233	.280	.216	.224	.249	.255	.001		.009
Incisor enamel (percent)	.003	.005	(.004)	.044	.053	.053	.057	.053	.064	.001	0.006	.012
Incisor dentin (percent)	.004	.008	(.007)	.244	.256	.213	.336	.266	.284	.001	.004	.007
Mandible (percent)	.009	.006	(.007)	.383	.524	.476	.528	.533	.520	.003	.006	.010
Mandible total (mg.)	.01	.02	(.02)	1.2	1.1	1.3	1.1	1.3	1.1	.01	.01	.03
Femur (percent)	.004	.009	(.007)	.419	.496	.497	.488	.555	.619	.006	.007	.012
Femur total (mg.)	.04	.01	(.03)	2.2	2 2	2.4	2 0	2.3	2.3	.03	.03	.06
	Percent ash content of teeth and bones											
Molar enamel	94.8	94.7	[1](94.7)	94.2	94.4	94.6	94.4	94.4	94.3	94.2	94.4	94.2
Molar dentin	75 8	74.9	(75.3)	76.9	77.1	77.6	76.8	77.0	77.4	76.4	77.1	75.7
Incisor enamel	95.6	95.2	(95.4)	94.8	94.5	94.8	95.2	94.5	95.2	94.8	94.9	94 6
Incisor dentin	75.3	75.6	(75.5)	73.4	75.0	76.0	75.6	75.1	74.9	74 6	75 1	75.3
Mandible	69.9	70.5	(70.2)	71.5	71.0	72.1	72.3	72.2	70.9	70.2	69 8	70 8
Femur	69.7	64.9	(67.3)	68.1	66.5	68 4	70.5	70.8	66.2	66 1	66.9	68.6
Enamel striations	(2)	(2)	(2)	(3)	(3)	(3)	(3)	(3)	(3)	(2)	(2)	(2)

[1] Arithmetic mean of male and female control rats. [2] None. [3] Marked.

fluorine could be deposited as trifluoroacetate or some metabolic intermediate, which would not be detected by the Willard and Winter procedure (*14*). Thus, when standard solutions of CF_3COONa were added to fresh bone samples, which were then ashed and distilled in the usual procedure (*14*), no fluorine was found in the distillate. However, CF_3COONa added to ashed bone resulted in 62.4 percent of fluorine recovery, indicating some interference due to the organic matrix of skeletal tissues. The recovery of fluorine added as CF_3COONa to bone could be improved by a preliminary distillation of the fresh bone plus CF_3COONa, using H_2SO_4 at 160° to 165° C., followed by a second distillation using $HClO_4$ (*15*); 81.1 percent of the CF_3COONa was recovered by this procedure. Bone samples alone



Fluorine in ash of bones and teeth of rats receiving fluorine as NaF, Na_2SiF_6, Na_2PO_3F, KPF_6, and CF_3COONa.

analyzed by this technique gave no fluorine over and above that obtained by the usual $HClO_4$ distillation.

It seems reasonable to assume, therefore, that no fluorine, free or combined, was deposited in these animals' skeletal or dental tissues. Availability of fluorine in NaF, Na_2SiF_6, and Na_2PO_3F, however, was similar and pronounced, as indicated by the high fluorine content of the skeletal and dental tissues of rats exposed to these fluorides. The similarity in availability of fluorine in NaF and Na_2SiF_6 was previously shown by McClure (*1*) and the availability of fluorine in Na_2PO_3F as fed to hamsters was also previously reported (*11*). It is of interest to note the similarity of the fluorine deposits in molar dentin and incisor dentin. Although the incisor is actively growing as compared with the fully developed molar, both have retained similar quantities of fluorine in the dentin.

Differences in skeletal fluorine deposition from oral vs. injected NaF, Na_2SiF_6, and Na_2PO_3F were found not to be statistically significant according to Fisher's "t" test (*20*). The same holds true for fluorine deposition in dental tissues with the exception of molar enamel. As previously noted, more fluorine is present in the molar enamel of rats receiving NaF, Na_2SiF, and Na_2PO_3F orally than by injection. This difference may be due to adsorption of fluorine on the enamel surface from orally administered fluoride. As also noted above, this may account to some extent for the inability of injected fluorides to inhibit caries.

Data for the ash content of the bones and teeth are similar for all groups and are indicative that no quantitative changes in calcification may be attributed to these various fluoride compounds. By comparison with control rats, the average daily gain in weight was not affected by any of the fluorides fed.

Discussion

The observed cariostatic effects of NaF and Na_2SiF_6 extend our previous evidence of a similar physiological availability of the fluorine in these two compounds (*1*) and would appear to further justify the use of Na_2SiF_6 for domestic water fluoridation. The close physiological identity of these two compounds is not surprising as both compounds liberate fluoride ions in dilute aqueous solutions.

The effects of Na_2PO_3F paralleled those of NaF and Na_2SiF_6 in all regards. Our results thus point to an effect of the fluoride ion, per se, liberated during the metabolism of Na_2PO_3F. However, Shourie et al. (*11*) suggest that fluorine does not have to exist as the free ion to inhibit caries. These investigators' supposition that Na_2PO_3F is not hydrolyzed in the body is, at present, based on indirect evidence that Na_2PO_3F, both orally and parenterally administered in single doses, is 2.5 to 3 times less toxic that NaF on the basis of fluorine content.

Further studies seem to be in order to clarify the *in vivo* hydrolysis of Na_2PO_3F. The data of our experiments support the belief that Na_2PO_3F is metabolized by the rat in a manner similar to NaF and Na_2SiF_6, since all these compounds had similar effects on dental caries, enamel striations, and storage of skeletal and dental tissue fluorine. This belief is also supported by the statement that Na_2PO_3F slowly hydrolyzes in acid solution to give fluoride ions.[5]

Viewed as a basic problem in the metabolism of fluorine, the results obtained with KPF_6 and CF_3COONa are perhaps the most interesting outcome of this study. Fluorine in these combinations seems to be totally unavailable to the rat when administered either orally or parenterally.

There seems to be a relation of "saturation" of fluorine in complex fluorides (perfluoro compounds) to the physiological stability of fluorine. Thus, sodium monofluoroacetate appears to be metabolized to furnish inorganic fluoride (*9*), whereas sodium perfluoroacetate (CF_3COONa) does not yield inorganic fluoride. Similarly, sodium monofluorophosphate is metabolized, whereas potassium perfluorophosphate (KPF_6) does not appear to be hydrolyzed by the rat. It would seem, therefore, that the metabolism of simple and complex fluorides does not follow a similar pattern, and more evidence is needed to elucidate these differences.

Summary

A comparative study of the physiological effects of NaF, Na_2SiF_6, KPF_6, Na_2PO_3F, and CF_3COONa was made using the young growing rat as the experimental animal. Fluorine was ingested in the drinking water at a level of 50 ppm and, with the exception of CF_3COONa, all the compounds were also injected intraperitoneally. NaF, Na_2SiF_6, and Na_2PO_3F in the drinking water reduced dental caries, deposited fluorine in the bones and teeth, and caused marked incisor striations to essentially the same extent. None of the fluorides had any cariostatic effect when administered by intraperitoneal injection. However, injected NaF, Na_2SiF_6, and Na_2PO_3F produced enamel striations and deposited fluorine in the bones and teeth. KPF_6 and CF_3COONa were physiologically inert insofar as could be indicated by caries inhibition, enamel striations, and deposition of fluorine in bones and teeth.

The data suggest that NaF, Na_2SiF_6, and Na_2PO_3F may be equally effective as water fluoridating agents for caries prevention.

ACKNOWLEDGMENTS

We are indebted to Chemist H. G. McCann of the National Institute of Dental Research for the purification of Na_2PO_3F and for the fluorine analysis of KPF_6 and CF_3COONa by the PbClF precipitation procedure.

[5] Ozark-Mahoning Co., FP Compounds. Tulsa, Okla.

We are also indebted to the Ozark-Mahoning Company, Tulsa, Okla., for Na_2PO_3F and KPF_6 and to the Hooker Electrochemical Company, Niagara Falls, N. Y., for CF_3COONa.

REFERENCES

(1) McClure, F. J.: Availability of fluorine in sodium fluoride vs. sodium fluosilicate. Pub. Health Rep. **65**:1175 (1950).
(2) Hein, J. W., Smith, F. A., Gardner, D. E., Downs, W. L., Maynard, E. A., and Hodge, H. C.: Further studies of the caries inhibitory potential and acute toxicity of complex fluorides. J. Dent. Res. **30**:466 (1951).
(3) Kempf, C. A., and Nelson, V. E.: The effect of fluorides on the teeth. Iowa Acad. Sc. **43**:197 (1936).
(4) Kempf, C. A., Greenwood, D. A., and Nelson, V. E.: Studies relating to the toxicity of fluorine compounds. J. Lab. Clin. Med. **22**:1133 (1937).
(5) Boyer, P. D., Evans, R. J., and Phillips, P. H.: The toxicity and effect of certain fluorinated derivatives of phenylalanine and tyrosine on the basal metabolic rate of the rat. J. Pharmacol. and Exper. Therap. **73**:176 (1941).
(6) White, W. E.: Flural, a new flocculating-fluoridating agent for municipal water treatment (abstract). *In* Abstracts of papers, 119th meeting, American Chemical Society, 1951, p. 2R.
(7) Euler, H., and Eichler, O.: Über die Wirkung von Fluor in organischer Bindung auf das Zahnsystem der Ratte. Arch. f. Exper. Path. u. Pharmakol. **199**:179 (1942).
(8) Armstrong, M. D., and Lewis, J. D.: Effect of phenylalanine on the toxicity of 4-fluorophenylalanine for the rat. J. Biol. Chem. **190**:46 (1951).
(9) Hagan, E. C., Ramsey, L. L., and Woodard, G.: Absorption, distribution, and excretion of sodium fluoroacetate (1080) in rats. J. Pharmacol. and Exper. Therap. **99**:432 (1950).
(10) Keyes, P. H., and Shourie, K. L.: Dental caries in the Syrian hamster. V. The effect of three different fluoride compounds on caries activity. J. Dent. Res. **28**:138 (1949).
(11) Shourie, K. L., Hein, J. W., and Hodge, H. C.: Preliminary studies of the caries inhibiting potential and acute toxicity of sodium monofluorophosphate. J. Dent. Res. **29**:529 (1950).
(12) Cox, G. J., Dodds, M. L., Dixon, J. F., and Matuschak, M. C.: Experimental dental caries. III. A system of recording corn meal caries in rats. J. Dent. Res. **18**:469 (1939).
(13) Manly, R. S., and Hodge, H. C.: Density and refractive index studies of dental hard tissues. II. Methods for separation and determination of purity. J. Dent. Res. **18**:133 (1939).
(14) Willard, H. H., and Winter, O. B.: Volumetric method for determination of fluorine. Indust. and Engin. Chem. (Analyt. Ed.) **5**:7 (1933).
(15) Association of Official Agricultural Chemists: Official and Tentative Methods of Analysis. Ed. 7. Washington, The Association, 1950.
(16) McClure, F. J.: Microdetermination of fluorine by the thorium nitrate titration. Indust. and Engin. Chem. (Analyt. Ed.) **18**:171 (1939).
(17) Hillebrand, W. F., and Lundell, G. E. F.: Applied Inorganic Analysis. New York. John Wiley & Sons, Inc., 1929.
(18) Arnold, F. A., Jr., and McClure, F. J.: Observations on induced dental caries in rats. V. Effect of subcutaneous injection of fluoride. J. Dent. Res. **20**:457 (1941).
(19) McClure, F. J.: Observations on induced caries in rats. III. Effect of fluoride on rat caries and on composition of rats' teeth. J. Nutrition **22**:391 (1941).
(20) Snedecor, G. W.: Statistical Methods. Ed. 4. Ames, Iowa State College Press, 1946.
(21) Oil, Paint, and Drug Reporter. June 25, 1951 issue.

Histoplasmosis Survey of Dogs in Louisville, Kentucky

By John W. Robinson, M.S., and Emil Kotcher, D.Sc.*

The east central portion of the United States has been regarded as an area in which infection with *Histoplasma capsulatum*, a diphasic fungus, is endemic (*1*). This area extends from Kansas City eastward and from southern Iowa and Ohio south through Tennessee (*2*). The belief that this is an endemic area of histoplasmosis is based on two sets of data. First, a disproportionately large number of the more than 100 cases of human histoplasmosis that have been reported in the medical literature have come from this area (*3*). Second, histoplasmin skin sensitivity surveys have shown that a high percentage of individuals native to this area give a positive reaction (*2, 4, 5*).

In regard to the first set of data, human histoplasmosis has been reported from other areas of the United States, Central and South America, Europe, South Africa, the Philippines, and Asia. It is possible that the east central area of the United States has had more cases reported because of greater awareness by the clinicians and laboratories in looking for this infection, particularly because this area has a high incidence of pulmonary calcification in human beings who also give negative tuberculin reactions. The disease has, however, been looked for in other parts of the world, Brazil, Panama, Italy, and South Africa, by competent clinicians and mycologists, and a similarly large number of cases has not yet been found.

There has been considerable controversy in regard to the second set of data, which is based on the histoplasmin intradermal test. The controversy has centered largely about the specificity of histoplasmin since cross reactions with other systemic fungus infections have been reported (*6, 7*). Howell (*8*) has confirmed earlier observations of Emmons, et al. (*6*) that in experimental animals skin reactivity varies with the lot of histoplasmin used, the dilution of the antigen, and the physiological status of the animal. Howell recommended the standardization of histoplasmin as to both antigenicity and dilution in order to be more certain of its degree of specificity and its comparative use with other antigens in order to make a reliable diagnostic interpretation.

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*From the Department of Microbiology, School of Medicine of the University of Louisville. Presented before the Southern Branch of the American Public Health Association April 27, 1951, at Biloxi, Miss. This investigation was carried out in partial fulfillment by the senior author for the degree of master of science and was supported by a medical research grant of the Commonwealth of Kentucky.

Emmons (*9*) has approached the problem of geographic distribution of human histoplasmosis in a different manner. His approach to this problem is based on the observation that animals are susceptible to histoplasmosis, and the isolation of *H. capsulatum* from wild-caught dogs, cats, rats, and other animals definitely establishes the presence of the fungus in the area. *Histoplasma,* therefore, constitutes a potential hazard to man in such an area. Ruhe and Cazier (*10*) have reviewed the literature on the incidence of histoplasmosis among animals, and Emmons (*9*) has summarized surveys of animals from various areas in the Unites States in order to determine the presence of this disease. Thus far, some 35 dogs from various parts of the world, though chiefly from the United States, have been found naturally infected. Emmons has also found the house mouse, brown rats, roof rats, domestic cats, spotted skunks, and an opossum naturally infected with *H. capsulatum* in his surveys.

During the past 10 years about 10 cases of acute histoplasmosis have been diagnosed in persons coming to the Louisville medical clinics. These cases were mostly in infants and children from central Kentucky and southern Indiana, as well as Louisville. In view of the fact that there have been only a little more than 100 cases reported in the medical literature, these 10 cases seem to be an unusually high number for such a small area. It seemed to us that this apparently high incidence of human infection might be complemented by a high incidence of animal infection. For this reason, a survey was made for evidence of the infection in dogs of the Louisville area.

Material and Methods

Preparation of Dog Cultures

All animals used in the survey were obtained from the Louisville dog pound from March 1950 through January 1951. These dogs were all routine admissions with no selection being made as to age, sex, or breed. Some selection was made in regard to size and rabid condition. All dogs weighing approximately 100 pounds or more were excluded to facilitate transportation. Also, dogs suspected of rabies could not be obtained for study. All dogs were killed with carbon monoxide gas and were autopsied within 2 hours after death. Before autopsy, the ventral and left lateral surfaces of the dogs were thoroughly wetted with 70 percent ethyl alcohol. Sterile instruments were used for each dog. Under as aseptic conditions as possible, the left humerus and a small portion of the spleen (approximately 2 inches long and 1 inch wide) were removed. The humerus was used as a source of bone marrow. The liver and lungs were examined grossly for lesions, but no specimens were taken unless gross pathology was evident.

Cultures were made from both the spleen and bone marrow. A

small portion of the spleen (approximately one-fourth-inch square) was streaked over the surface of a modified Sabouraud's agar slant and left near the top of the slant. The humerus was then opened with bone scissors or with a carpenter's hammer. Two to three loopsful of the exposed bone marrow were inoculated into the following culture media: a modified Sabouraud's agar slant and a modified Sabouraud's agar slant containing 20 units of penicillin G and 40 units of dihydrostreptomycin hydrochloride per milliliter of medium. All cultures were incubated at room temperature and examined at the end of 2 and 4 weeks before being discarded as negative.

A bone marrow smear and a splenic impression were made from each dog. These preparations were stained with Leishman's stain and the entire slide was examined for *H. capsulatum.*

Infected Mouse Experiment

To determine the effect of carbon monoxide gas on *H. capsulatum,* seven white mice of unknown strain were inoculated intraperitoneally with 0.5 ml. of a saline suspension of *H. capsulatum* (our Sallee strain, ground mycelial phase). One month from the date of inoculation these mice were killed in the same carbon monoxide gas chamber used for killing the dogs and were exposed to the gas for the same length of time as were the dogs. The mice were then taken directly to the autopsy room and autopsied under the conditions outlined in the dog experiment. Small portions of spleen and liver (approximately one-fourth-inch square) were streaked over the surface of a modified Sabouraud's agar slant and usually left near the top of the slant. These cultures were incubated at room temperature and examined at the end of 4 weeks.

The cultures made with portions of the infected mouse spleens and livers were carefully examined microscopically and the large tuberculate chlamydospores characteristic of *H. capsulatum* were found in every culture.

The results of this control experiment indicate that carbon monoxide gas does not kill *H. capsulatum* in infected tissue.

Results

The direct microscopic examination of stained bone marrow smears and splenic impressions from 303 dogs collected in the Louisville area during the period from March 1950 to January 1951, failed to reveal the fungus, *H. capsulatum,* in any instance. All cultures of bone marrow and portions of spleen from these dogs were also negative for *H. capsulatum* after incubation at room temperature for 1 month.

Discussion

The negative results obtained in this survey may be explained in

two ways. First, the isolation technique of the investigators may have been faulty and inadequate in recovering the fungus in the tissues of the dogs at autopsy. Second, the spleens and bone marrow of the dogs may not have been infected with the fungus at the time of examination. There is some indication that rural animals are more likely to be infected with *Histoplasma* than urban animals, on the basis of Emmons' report (*9*). It may be for this reason that these Louisville dogs were negative. It must be noted, however, that although these dogs were obtained from the Louisville dog pound, there was no way of determining whether the dogs had spent their full lives in Louisville.

The culture technique used in this survey is the same as that employed by Emmons and Ashburn (*11*) in their survey of histoplasmosis in wild rats. A modified Sabouraud's medium was used by them. This medium has been shown to be quite satisfactory in recovering *H. capsulatum* from infected tissues in some of our unpublished experiments (*18*).

As this fungus primarily infects the reticulo-endothelial tissues, the spleen and bone marrow samples of infected animals readily reveal the yeast-like, parasitic phase of the organism. The researches of Howell (*12*), Emmons and Ashburn (*11*), Ruhe and Cazier (*10*), and Menges, Furcolow and Ruhe (*13*), as well as our own unpublished work (*18*), indicate that the spleen and bone marrow harbor the parasite in a very high percentage of infected animals. In view of these facts, it seems unlikely that our failure to find any infected animals was the result of an inadequate technique.

The question of animal reservoirs for *H. capsulatum* has been raised by a number of investigators. Ruhe and Cazier (*10*) believe that domestic animals, like the dog, may serve as reservoirs and play a significant role in the epidemiology of this infection. A number of reported human cases had contact with dogs. Thus, Para (*14*) cites a case of a Brazilian child who had contact with a *Histoplasma*-infected dog. Kuzma and Schuster (*15*) have reported a fatal case of histoplasmosis in a dog breeder. Olson, Bell, and Emmons (*16*) reported human and canine cases in Loudoun County, Virginia, although there was no proved contact between the infected human beings and dogs. In spite of these few cases in which there may have been some association between the human and canine cases, the vast majority of human cases have given no evidence of contact with infected dogs. It seems likely that dogs are merely coincidental hosts for this parasite and play no significant role in the epidemiology of human infections. This fact seems to be borne out partially by our findings, since no canine infections were found, although human infections were reported in this area. It is interesting to note, however, that McClellan (*17*) has recovered *H. capsulatum* from five dogs from the Lexington, Ky.,

area in a period of about 2 years. These sick dogs were referred to him by veterinarians and dog owners and, therefore, represented a selected group.

Summary

A search for *H. capsulatum* was made on 303 dogs collected in the Louisville, Ky., area between March 1950 and January 1951. No selection of dogs was made with the exception that all dogs suspected of being infected with the rabies virus and those weighing 100 or more pounds were excluded.

The direct microscopic examination of stained bone marrow smears and splenic impressions failed to reveal the fungus in the 303 dogs. Cultures of bone marrow and portions of spleen from these dogs failed to yield organisms resembling *H. capsulatum* when incubated on a modified Sabouraud's medium at room temperature for 1 month.

REFERENCES

(*1*) Smith, Charles Edward: Coccidioidomycosis. Med. Clin. North America **27:** 790–807 (1943).

(*2*) Palmer, Carroll E.: Geographic differences in sensitivity to histoplasmin among student nurses. Pub. Health Rep. **61:** 475–487 (1946).

(*3*) Pinkerton, Henry: Histoplasmosis. Adv. Int. Med. **3:** 197–236 (1949).

(*4*) Christie, A., and Peterson, J. C.: Histoplasmin sensitivity. J. Pediat. **29:** 417–432 (1946).

(*5*) Furcolow, M. L., High, R. H., and Allen, M. F.: Some epidemiological aspects of sensitivity to histoplasmin and tuberculin. Pub. Health Rep. **61:** 1132–1143 (1946).

(*6*) Emmons, C. W., Olson, B. J., and Eldridge, W. W.: Studies on the role of fungi in pulmonary disease. I. Cross reactions to histoplasmin. Pub. Health Rep. **60:** 1383–1394 (1945).

(*7*) McCleod, J. H., Emmons, C. W., Ross, S., and Burke, F. G.: Histoplasmosis. A report of four cases, two in siblings. Histoplasmin test and other diagnostic procedures. J. Pediat. **28:** 275–295 (1946).

(*8*) Howell, A.: Studies of fungus antigens. I. Quantitative studies of cross-reactions between histoplasmin and blastomycin in guinea pigs. Pub. Health Rep. **62:** 631–651 (1947).

(*9*) Emmons, C. W.: Histoplasmosis: Animal reservoirs and other sources in nature of the pathogenic fungus, *Histoplasma*. Am. J. Pub. Health **40:** 436–440 (1950).

(*10*) Ruhe, J. S., and Cazier, P. D.: A review of histoplasmosis. J. Am. Vet. Med. Assoc. **115:** 47–50 (1949).

(*11*) Emmons, C. W., and Ashburn, L. L.: Histoplasmosis in wild rats. Occurrence and histopathology. Pub. Health Rep. **63:** 1416–1422 (1948).

(*12*) Howell, Arden, Jr.: The efficiency of methods for the isolation of *Histoplasma capsulatum*. Pub. Health Rep. **63:** 173–178 (1948).

(*13*) Menges, Robert W., Furcolow, J. L., and Ruhe, J. S.: Experimental histoplasmosis in a dog. A nonfatal case. Pub. Health Rep. **65:** 628–631 (1950).

(*14*) Para, M.: Histoplasmosis in Brazil. Am. J. Trop. Med. **26:** 273–292 (1946).

(*15*) Kuzma, J. K., and Schuster, M.: Histoplasmosis—Reticulo-endothelial cytomycosis; Report of a case from Wisconsin. Wisconsin M. J. **45:** 591–595 (1946).

(*16*) Olson, B. J., Bell, J. A., and Emmons, C. W.: Studies on histoplasmosis in a rural community. Am. J. Pub. Health **37:** 441–449 (1947).

(*17*) McClellan, J. F.: Personal communication. (1951).

(*18*) Kotcher, Emil, Robinson, John W., and Miller, Madelyn P.: Isolation of *Histoplasma capsulatum* from tissues of experimentally infected white mice. (In press).

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Relative Pathogenicity of Certain *Salmonella* Strains for Man and Mice

By NORMAN B. MCCULLOUGH, Ph.D., M.D.*

During a study of the pathogenicity for man of certain *Salmonella* strains, the minimal infective dosage for man of a number of species and strains was determined. An opportunity was thus afforded to determine the relative pathogenicity of these species and strains for man and mice.

Materials And Methods

The materials and methods employed in the study on experimental human salmonellosis have been previously described and the results presented in detail (*1–4*). The *Salmonella* strains employed were obtained from spray-dried whole egg and were isolated by the Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture. The ID_{50} of these strains for mice was determined according to the procedure of Reed and Muench (*5*). The organisms were grown for 24 hours on trypticase-soy agar (B–B–L). The growth was suspended in saline and the resulting suspensions were standardized turbidimetrically. Decimal dilutions were prepared in saline and the calculated dosages were injected intra-abdominally into mice. At the same time, decimal dilutions of each inoculum were cultured in duplicate on trypticase-soy-agar medium for determination of bacterial count. Adult white mice weighing approximately 20 grams each were employed. The mice were obtained from a colony maintained at the laboratory for several years without clinical or bacteriological evidence of *Salmonella* infection. Fifty mice were used for each strain with groups of 10 receiving the same dosage. At the end of 2 weeks, surviving mice were sacrificed and the liver, spleen, and heart's blood were cultured on SS agar (Difco). Some of the mice died prior to the expiration of the 2-week period. In culturing these carcasses, portions of liver and spleen were also cultured in tetrathionate broth (Difco) containing brilliant green 1/100,000 and subsequently subcultured on SS agar medium. The resulting isolates were identified by the usual procedures and specifically typed according to the Kauffmann-White schema.

*From the Department of Medicine, University of Chicago, and the Microbiological Institute of the National Institutes of Health, Public Health Service. A report of work done under contract between the Food Research Institute of the University of Chicago and the U. S. Department of Agriculture, as authorized by the Research and Marketing Act. The work was sponsored by the Bureau of Agricultural and Industrial Chemistry.

Results

The table presents the strains according to the dosages which produced illness in man and the ID_{50} for mice. It is clearly apparent that the ID_{50} for mice of these strains is in no way correlated with the dosage producing disease in man. Most of the strains did not kill mice even in dosages as large as 100 million; hence the LD_{50} was not determined. Exceptions to this were *Salmonella newport* and *Salmonella derby*. With *S. newport*, of eight infected mice in a group of ten, there were three deaths at a dosage of 11.7 million. Seven of nine infected mice receiving 121 million organisms died. With *S. derby*, of ten mice infected at a dosage of 141 million organisms, there were three deaths. None of the other strains produced death in any mice at dosages up to 100 million or slightly greater.

Discussion

Several strains of *Salmonella pullorum* were studied in the human experiments, but no data for these strains are included in this report. Although *S. pullorum* was recovered from some mice at all levels employed, even with a dosage of 10,000 organisms, recovery was so irregular that a satisfactory ID_{50} for these strains could not be obtained. Furthermore, the human volunteers employed in the studies had all received typhoid immunization, some of them on repeated occasions. As the dosage of *S. pullorum* required to produce illness in these subjects was markedly greater than for any of the other species, one may question whether, in view of the somatic antigenic similarity of *S. pullorum* and *Salmonella typhosa*, significant

Showing relative pathogenicity of certain Salmonella *strains for man and mice*

Organism	Clinical illness in man		ID_{50} for mice in millions of organisms
	Dosage in millions of organisms	Fraction of group becoming ill	
S. meleagridis, Strain I	24	1/5	119
	50	4/6	
S. meleagridis, Strain II	10	1/6	9
	20	2/6	
	41	5/6	
S. meleagridis, Strain III	7.7	1/6	103
	10	2/6	
S. anatum, Strain I	.59	2/6	17
	.86	3/6	
S. anatum, Strain II	44.5	1/6	7.8
	67.2	4/6	
S. anatum, Strain III	1.2	2/6	7.6
	4.7	4/6	
S. newport	.15	1/6	.92
	.38	1/6	
	1.3	3/6	
S. bareilly	.12	1/6	59
	.69	2/6	
	1.7	4/6	
S. derby	15	3/6	.39

immunity may have been conferred against *S. pullorum* by such immunization. The infective dosages of *S. pullorum* for man thus determined may not be comparable to those obtained with the other species.

The relatively large dosages of most of these strains which were required to infect mice are of interest. This may be a reflection of the previous history of the cultures which were obtained from spray-dried egg and hence presumably were fowl-adapted strains.

The routes used to produce infection in man and mice were necessarily different, but both were those which would normally be employed. Likewise, the infections cannot be regarded as comparable.

It is interesting to speculate whether the lack of relationship of the pathogenicity for man and mice shown here is peculiar to the strains in question, or whether strains from other sources, particularly mouse-adapted strains, might behave differently.

Summary

The pathogenicity for man of three strains each of *Salmonella meleagridis* and *Salmonella anatum* and one strain each of *S. newport*, *Salmonella bareilly*, and *S. derby* were determined by administering these organisms to human volunteers. The ID_{50} for mice, using the intra-abdominal route, was determined for each strain. There was no apparent relationship between the pathogenicity of these strains for human volunteers and the ID_{50} for mice.

REFERENCES

(*1*) McCullough, N. B., and Eisele, C. W.: Experimental human salmonellosis. I. Pathogenicity of strains of *Salmonella meleagridis* and *Salmonella anatum* obtained from spray-dried whole egg. J. Infect. Dis. **88:** 278–289 (1951).

(*2*) McCullough, N. B., and Eisele, C. W.: Experimental human salmonellosis. II. Immunity studies following experimental illness with *Salmonella meleagridis* and *Salmonella anatum*. J. Immunol. **66:** 595–608 (1951).

(*3*) McCullough, N. B., and Eisele, C. W.: Experimental human salmonellosis. III. Pathogenicity of strains of *Salmonella newport*, *Salmonella derby*, and *Salmonella bareilly* obtained from spray-dried whole egg. J. Infect. Dis. (In press).

(*4*) McCullough, N. B., and Eisele, C. W.: Experimental human salmonellosis. IV. Pathogenicity of strains of *Salmonella pullorum* obtained from spray-dried whole egg. J. Infect. Dis. (In press).

(*5*) Reed, L. J., and Muench, H.: A simple method of estimating 50 percent endpoints. Am. J. Hyg. **27:** 493–497 (1938).

Plague in the Territory of Hawaii

II. Plague Surveillance, Hamakua District, Island of Hawaii

By Bertram Gross, M.S., and David D. Bonnet, Ph.D.*

The current status of plague infection in the Island of Hawaii has recently been published (*1*), and the routine plague surveillance program is discussed in this report. The program was established to determine when plague infection is present in rodents and their ectoparasites and where it is found.

In the Hamakua coast region plague surveillance activities are currently conducted in an area approximately 3 to 5 miles wide extending from the village of Ookala, located 32 miles northwest of the port of Hilo, to Waipio Valley 20 miles beyond Ookala. The upper or mountain-side limit of this narrow plague infected coastal region roughly follows the 2,000-foot elevation contour. The area below this level slopes sharply towards a rugged, almost vertical, pali or cliff which drops off abruptly to the sea. There are many gorges or gulches which tortuously make their way down toward the ocean. Many of these gulches, which are deep and precipitous, have been produced by, and are subject to, flash streams. They are heavily covered with vegetation, are difficult of access, and afford ample food and harborage for rodents.

Sugar cane is cultivated extensively throughout the region. Approximately 20,000 acres are planted in cane. These fields border on plantation communities and villages and extend to the edges of the gulches. The dense growths of the mature sugar cane furnish ideal harborage for rodents and a preferred type of food is available continuously until the field is harvested. At harvest time, usually 18 to 22 months from planting, rodents migrate to adjacent canefields or to the gulches.

According to the preliminary figures of the 1950 census, the number of persons residing in the Hamakua District is 5,973. The population living in the region are Filipinos, Japanese, Chinese, Hawaiians, part Hawaiians, and Caucasians. The majority live in small villages or plantation communities located below an elevation of 1,500 feet. The villages are essentially rural and, in most instances, they are contiguous to rodent infested canefields, gulches, or woodlands.

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Four species of rats are found in the Hamakua region. These are *Rattus hawaiiensis* Stone, *Rattus rattus rattus* (Linn.), *Rattus rattus alexandrinus*[1] (Geoffroy), and *Rattus norvegicus* (Erxleben). One mouse species is present, *Mus musculus* Linn. Plague infection has been determined in each of the above named species. As far as is known, no other rodent species is present which plays an active role in the transmission of plague in this region. The mongoose, *Herpestes javinicus auropunctatus* (Hodgson), is present in fairly large numbers. Although one trapped specimen was proved to be naturally infected with *Pasteurella pestis* by Passed Assistant Surgeon George W. McCoy, United States Public Health and Marine Hospital Service, in February 1912, no additional evidence is available that this animal actively figures in the transmission of plague infection in Hawaii.

Seven species of fleas are known to occur in the Territory of Hawaii all of which are present in the Hamakua region. These are *Xenopsylla cheopis* (Rothschild), *Ctenocephalides felis* (Bouché), *Nosopsyllus fasciatus* (Bosch), *Echidnophaga gallinacea* (Westw.), *Leptopsylla segnis* (Schönherr), *Pulex irritans* Linn, and *Xenopsylla hawaiiensis* Jordan. Augustson(*2*) has recently shown that this species is apparently identical with a species from Australia, *Xenopsylla vexabilis*, previously described by Jordan, and has reduced *X. hawaiiensis* to a synonym. The role played by fleas in plague transmission in Hawaii was discussed by Eskey (*3*), who concluded, primarily on epidemiological grounds, that *X. cheopis* and *X. hawaiiensis* Jordan were the principal insect vectors of plague in Hawaii.

Methods

The over-all goal of the plague surveillance and suppressive programs of the Bureau of Rodent Control of the Territorial Department of Health is to provide the people of this region and of the Territory with the maximum protection that is practicable against plague infection (*1*). Therefore, in the interests of the persons residing in the Hamakua region, surveillance and control efforts are currently directed toward those areas in, and immediately adjacent to, villages and plantation communities. The rodents which are examined for evidence of plague infection are obtained by trapping, gassing, and clubbing, or, they are found dead.

Approximately 5,000 snap traps are operated on a daily basis. About a third of this number is set within the communities. The remainder is utilized to make up fixed trap lines which extend about the

[1] Some authors distinguish between the Gray Bellied Roof Rat, *Rattus rattus alexandrinus* (Geoffroy) and the White or Lemon-Yellow Bellied Tree Rat, *Rattus rattus frugivorus* Rafinesque. These forms are considered to be subspecies of the Black Rat, *Rattus rattus* (Linn.). In Hawaii, these three forms have similar habits and are not infrequently found inhabiting the same nest. For practical reasons and because of the intergrading of belly-coloration, all gray and varicolored forms are classified as *R. r. alexandrinus* (Geoffroy) to distinguish them from the readily separated Black Rat, *Rattus rattus rattus* (Linn.).

periphery of the villages and camps. At the present time, rat snap traps are used almost exclusively. Each trap has a number painted on it and is treated with a wood preservative to protect it. The springs are lubricated with grease at frequent intervals to insure instantaneous snapping of the striker bow. These treatments do not appear to have any deterrent effect on the rodent catch.

Servicing of the trap lines begins at 6 a. m. so that trapped rodents may be retrieved as quickly as possible before they can be eaten or mangled by the mongoose which is diurnal in habit. Traps are baited with pieces of coconut meat approximately 1 inch square. An area of about 1 foot square is cleared adjacent to each trap station. After the trap is set, it is placed in the center of the cleared area and then tied securely with cord to a tree, bush, or some other stationary object. The traps which make up the lines that encircle the villages and camps are spaced 35 to 50 feet apart. Poison bait stations are located in between at equal intervals. The trapper in checking his line makes certain that the traps are in good working condition, resets the traps which have been sprung, and replaces missing or stale bait. The trapper carries with him a supply of cardboard tags which have been stamped with the number and letter of his trapping district. These tags also bear a rodent number which is one of a monthly series assigned to each man. When a rodent is caught, the trap number, the species, and sex are recorded on the tag which is then tied to the animal's leg. Pertinent details are entered in the trapper's field notebook and later transcribed to a daily rodent retrieval form. In this manner, it is possible to know exactly where every rodent is retrieved.

Considerable caution is exercised in the handling of dead rodents. The men do not touch the animals but free them by picking up the trap by the base and releasing the striker, allowing the rodent to fall into the particular type of receptacle that they are utilizing that day. On the days the rodents from a trapper's district are to be combed for fleas, the retrieved rodents are placed in a small paper bag in the field. One-quarter teaspoon of calcium cyanide is added to the bag, which is shaken and then tied tightly at the neck with string. This operation is conducted for two reasons: (1) To kill the fleas and to prevent them from escaping in transit, and (2) to protect workers in the laboratory. If the rodents from a trapper's district are not being used for flea combing on any given day, they are placed in gallon cans containing kerosene.

From time to time dead rodents are found in the plague infected region. Most of these are discovered by the men engaged in plague surveillance and suppressive activities. A few dead rodents are found by plantation workers or other members of the community and are reported to the local health office. The people of the region

have been thoroughly indoctrinated with the importance of not touching dead rodents. As a consequence, in nearly every instance a staff member, exercising adequate precautions, recovers the rodent.

The retrieval of rodents by gassing and clubbing, the management of poison stations located between traps, and other plague control measures will be discussed in a third article in this series.

The daily rodent retrieval is brought to the local plague laboratory, and all rats in good condition are dissected and examined macroscopically by experienced observers for evidence of plague infection. Special care is taken to note the condition of the liver, spleen, lungs, lymph glands, and subcutaneous blood vessels. When gross changes are observed, smears of suspected tissues or organs are stained with Wayson's stain and examined microscopically for the presence of bipolar staining plague-like organisms. The presence of plague-like organisms in the microscopical field together with the gross changes observed at autopsy are considered to be only a provisional diagnosis of plague infection. This procedure lends a basis for further suspicion and provides a quick check on possible active rodent plague infection. The failure to observe these organisms in the microscopic field is not held to be conclusive evidence of the absence of plague.

Following the microscopical examination of smears, suspect material is streaked on MacConkey's agar which is incubated at 20°–28° C. for 48 hours. Suspicious colonies are fished for further bacteriological investigation. At the same time, portions of the liver, spleen, heart, lymph glands, and lungs are triturated in normal saline and inoculated into a guinea pig. When the guinea pig becomes ill and dies within a 10-day period and typical plague-like lesions are noted at autopsy, or if bipolar staining organisms are seen in stained smears, a presumptive diagnosis of plague is made. If the guinea pig does not die within the 10-day period, it is sacrificed and then examined.

To confirm a presumptive diagnosis of plague, *P. pestis* is cultured and identified by biochemical tests. Currently, no reports of final diagnosis of positive plague infection are issued unless the provisional and presumptive diagnoses have been confirmed bacteriologically by the Bureau of Laboratories of the Territorial Department of Health. Complete reports on all rodent or rodent-flea plague infections are immediately forwarded to Federal health authorities and to local military commands.

Even though no gross evidences of plague infection are noted, rats and mice found dead or dying are treated as suspicious for plague and tissues from these animals are examined according to the above procedures. Decomposed or mummified rodents are not regularly utilized for inoculations because of the inherent difficulty of obtaining a satisfactory inoculum.

At regular intervals tissue is removed from groups of 15 to 20 rats

retrieved from the same trap line within a work zone and, after pooling and triturating in normal saline, is used to make a mass rat tissue inoculation into a guinea pig.

At the present time, approximately 20 mass mice tissue inoculations are undertaken each month. These inoculations are similar to those described for mass rat tissues. Mice are not regularly autopsied because of the time consumed in examining large numbers of small animals. Although plague infection has been detected in 24 out of 620 mice found dead and in 3 out of 688 mass mice tissue pools since 1940, it is generally considered that they play a relatively unimportant role in the spread of plague (*4*).

Systematic combing of rodents for fleas is carried on as a further check on the presence and distribution of plague infection in the region. The fleas, so obtained, are pooled by rodent species and by individual trap line, comminuted in normal saline, and inoculated subcutaneously into guinea pigs. These are known as "mass flea inoculations." The known endemic plague region is divided into six sections and although all sections are trapped daily, only the rodents retrieved in three sections are combed for fleas each day. This work is rotated to provide regular and progressive coverage of the entire region. In addition, the rodents retrieved in the zones on both sides of the North Hilo District boundary (*1*) are combed daily for fleas to determine if the plague region has been correctly delimited.

Discussion

The percentage of rats autopsied was consistently high for each calendar year during the period 1940 to 1950, as shown in table 1.

Table 1. *Number of rats retrieved and autopsied*

Calendar year	Number retrieved	Number autopsied	Percent autopsied	Retrieval method of autopsied rats		
				Trapped	Killed	Found dead
1940	32,306	30,038	93 0	25,914	2,229	1,895
1941	42,517	37,966	89.3	34,727	1,855	1,384
1942	55,597	50,365	90.6	45,603	3,922	839
1943	55,320	51,252	92.6	47,946	2,895	411
1944	38,727	35,168	90.8	31,518	3,482	168
1945	38,702	34,246	88.5	32,731	1,467	48
1946	19,556	19,115	97.7	18,599	486	30
1947	23,708	23,116	97.5	22,052	1,025	39
1948	18,908	18,676	98.8	17,556	1,097	23
1949	17,201	16,956	98.6	15,505	1,407	44
1950	13,496	13,431	99.5	12,656	758	17
Total	356,038	330,329	92.8	304,807	20,623	4,898

Of all the rats retrieved 92.8 percent were in a satisfactory condition and were autopsied for gross evidences of plague infection The remainder (7.2 percent) were partially eaten by mongooses, decom-

posed, or mummified and could not be autopsied satisfactorily. These figures represent a maximum practical effort to detect plague in the Hamakua region by this initial screening method.

The total trapped rats autopsied is numerically large compared to the number killed or found dead. The number varies from year to year, a fact attributable to fluctuations in rat populations, to the number of personnel available for the program, and to the degree of effort devoted to trapping activities. Variations in the number of rats killed are traceable to the emphasis placed on the gassing of burrows and rockpiles during any given period. The number of rats found dead each year also varies considerably, due in part to the same factors mentioned above for trapped and killed rats. During the period 1940 to 1944, when the incidence of plague infection in rats was high, intensive poison activities were conducted and special organized searches for dead rodents over wide areas were made. Such was not the case during the period 1945 to 1950.

When one examines plague infection in relation to the method by which the infected rats were retrieved (table 2), it immediately becomes apparent that the greatest number of infections were detected in individual rats found dead. By comparison, only a small portion of individual rats which were killed or trapped was found to be plague-infected. This may be due to the fact that sick or dying rats are usually not very active and cannot be flushed easily from burrows or taken by traps.

The autopsying of trapped rats has not resulted in the detection of a large amount of plague infection in Hamakua. Only 20 plague infections were detected in 304,807 trapped rats which were autopsied. The difficulties of detecting the plague organism by this method have previously been noted (*5, 6, 7*). However, it should be borne in mind that in addition to obtaining rodents for autopsy in the labo-

Table 2. *Plague infection detected in individual autopsied rats*

Calendar year	Total positive	Retrieval method					
		Trapped		Killed		Found dead	
		Number autopsied	Number positive	Number autopsied	Number positive	Number autopsied	Number positive
1940	53	25,914	2	2,229	3	1,895	48
1941	74	34,727	0	1,855	5	1,384	69
1942	122	45,603	7	3,922	7	840	108
1943	68	47,946	4	2,895	4	411	60
1944	42	31,518	4	3,482	0	168	38
1945	17	32,731	1	1,467	1	48	15
1946	6	18,599	1	486	0	30	5
1947	5	22,052	1	1,025	0	39	4
1948	2	17,556	0	1,097	0	23	2
1949	12	15,505	0	1,407	3	44	9
1950	0	12,656	0	758	0	17	0
Total	401	304,807	20	20,623	23	4,899	358

ratory, there are other important factors associated with the operation of trap lines. These are:

1. The men who check the trap lines pay special attention to the finding of dead rodents. Since the greatest number of plague infections have been detected in rodents found dead, every such rodent retrieved is regarded as particularly suspicious for plague and by this means, a continuous appraisal is made of the status of plague infection in and around villages and plantation camps. When a dead rodent is found and the laboratory makes a provisional diagnosis of plague, expeditious initiation of intensive plague suppressive measures becomes possible.

2. Trapped rodents are not only subjected to individual autopsy, but tissues are taken from them to make mass tissue inoculations. These rodents are also combed for fleas which are used to make mass flea inoculations. In this manner both rodent tissues and fleas are obtained from large numbers of animals over a wide area associated with human habitation and are available continuously for guinea pig inoculations.

3. Of 974,240 rodents retrieved (356,038 rats and 618,202 mice) during the period 1940 to 1950, more than 90 percent were obtained by traps. The trapping of nearly a million rodents in a 10-year period must have had some effect on the total rat population.

From table 3 it will be noted that during the years 1940 to 1950, 11 positive plague infections were detected among 2,153 mass rat tissue inoculations. Although there has been a decided increase in efforts to determine plague by mass tissue inoculation since 1946, there has been no corresponding increase in the number of infections detected. The lack of increase in plague detection by this method is difficult to evaluate for the years 1946 to 1950 as this was a quiescent period with the exception of one minor plague outbreak. An important

Table 3. *Plague infection detected by mass tissue inoculation*

Calendar year	Number rats autopsied	Number of rats contributing	Percent total autopsied	Mass tissue inoculations	
				Number of mass tissue inoculations	Number positive
1940	30,038			143	3
1941	37,966			36	0
1942	50,365	0	0.0	0	0
1943	51,252			4	0
1944	35,168	1,377	3.9	28	2
1945	34,246	1,877	5.5	46	1
1946	19,115	6,811	35.6	219	2
1947	23,116	8,339	36.1	271	2
1948	18,676	4,289	23.0	144	0
1949	16,956	8,407	49.6	459	0
1950	13,431	8,626	64.2	803	1
Total	330,329			2,153	11

Table 4. *Plague infection detected by mass flea inoculation*

Calendar year	Number fleas contributing	Mass flea inoculations	
		Number flea inoculations	Number positive
1941 [1]	2,606	58	5
1942	2,821	30	3
1943	759	14	0
1944	2,096	36	2
1945	2,459	62	2
1946	434	32	0
1947	1,725	137	1
1948	624	76	0
1949	2,267	183	6
1950	1,668	202	2
Total	17,459	830	21

[1] Mass flea inoculations not accomplished routinely prior to January 1941.

factor to consider from the standpoint of plague surveillance, however, is that in 1946 the procedure was established whereby tissue was taken from a much larger proportion of the total rats autopsied. This tissue was utilized in a greater number of mass tissue inoculations in a constant attempt to detect inapparent plague in rats retrieved in, and adjacent to, habitable areas located throughout the entire plague infected Hamakua region.

Plague was demonstrated in rat fleas 21 times in 830 mass flea inoculations as shown in table 4. Flea inoculations were first attempted routinely in the Hamakua region in January 1941. From this date until the latter part of 1946, the majority of the fleas utilized for such inoculations were obtained from rats cage-trapped in the peripheral areas of the region or from limited selected areas where plague foci were known to exist. In January 1947 this activity was reorganized and rats caught in snap traps throughout the entire region were combed for fleas and lice so that the scope and magnitude of the program to detect plague in rodent fleas was augmented (*8*). This intensified program did not result in the determination of an increased amount of plague.[2] Inasmuch as mass flea inoculation is generally considered to be a sensitive method of detecting plague infection (*9*), the lack of an increase in the number of infections detected in rat fleas may possibly be attributed to a low incidence of plague during this period.

In 1949 plague infection was detected six times by mass flea inoculation between February and August. These positive flea pools gave early warning of a possible reactivation of the infection throughout the region. During the following 3 months, plague was demonstrated in nine dead rats and one dead mouse, and in three killed

[2] From June 1947 to December 1950 a total of 140 mass lice pools were made involving 2,223 lice. All lice pools have proved negative for plague.

rats. In November a single human case was reported, the first in 4 years.

Summary

1. The immediate aim of the plague surveillance program conducted in the endemic plague region in Hamakua, Hawaii, is the determination of when plague infection is present in rodents and their ectoparasites and where it occurs.

2. Descriptions of the field and laboratory procedures employed in this plague detection program are given.

3. During the period 1940 to 1950, plague infections were detected in 460 rodents and their ectoparasites. Of this number, 358 were detected in rats found dead, 23 in killed rats, 20 in trapped rats, and 24 in mice found dead. In addition, 11 infections were determined by mass rat tissue inoculation, 3 by mass mice inoculation, and 21 by mass flea inoculation.

4. Emphasis is placed on the importance of finding dead rodents in and adjacent to communities, as the greatest number of plague infections were detected in rats found dead.

5. Since 1946 the effort to detect plague in rodents and rodent ectoparasites by means of mass tissue and mass flea inoculations has been greatly increased in and adjacent to habitable areas.

REFERENCES

(*1*) Gross, B., and Bonnet, D. D.: Plague in the Territory of Hawaii. I. Present status of plague infection, Island of Hawaii. Pub. Health Rep. **66**: 209–214 (1951).

(*2*) Augustson, G. F.: *Xenopsylla* fleas of the Hawaiian Islands (Siphonaptera: Pulicidae). Proc. Hawaiian Ent. Soc. **13**: 33–36 (1947).

(*3*) Eskey, C. R.: Epidemiological study of plague in the Hawaiian Islands. Public Health Bulletin, No. 213, pp. 1–70, 1934.

(*4*) Wu, Lien-Teh, Chun, J. W. H., Pollitzer, R., and Wu, C. Y.: Plague. A manual for medical and public health workers. Weishengshu, National Quarantine Service, Shanghai Station, China, 1936.

(*5*) Williams, C. L., and Kemmerer, T. W.: Plague infected rats without visible lesions. Pub. Health Rep. **38**: 1873–1881 (1923).

(*6*) Eskey, C. R.: Chief etiological factors of plague in Ecuador and the antiplague campaign. Pub. Health Rep. **45**: 2077–2115, 2162–2187 (1930).

(*7*) Meyer, K. F.: Sylvatic plague. Am. J. Pub. Health **28**: 1153–1164 (1938).

(*8*) Gross, B., and Bonnet, D. D.: Snap traps versus cage traps in plague surveillance. Pub. Health Rep. **64**: 1214–1216 (1949).

(*9*) Eskey, C. R., and Haas, V. H.: Plague in the western part of the United States. Infection in rodents, experimental transmission by fleas and inoculation tests for infection. Pub. Health Rep. **54**: 1467–1481 (1939).

Industrial Sickness Absenteeism Among Males and Females During 1950

—With Index of the Previous Publications of the Series—

By W. M. Gafafer, D.Sc.*

This report presents data on sickness absenteeism among male and female employees during the year 1950 and earlier years. The data are obtained from a group of reporting organizations comprising mutual sick benefit associations, group health insurance plans, and company relief departments and are limited to sickness and nonindustrial injuries causing absence from work for 8 consecutive calendar days or longer. Quarterly reports for 1950, based on the male experience of the reporting organizations have appeared (*1*, *2*). The last published report on both males and females was for the year 1949 (*1*).

Year, 1950. Table 1 presents frequency rates by cause for male and female workers during 1950 and comparable data for 1949 and the 10-year period 1941–50. During the year 1950, all sickness and nonindustrial injuries disabling for 8 consecutive calendar days or longer resulted in frequency rates of 116.8 per 1,000 males and 258.4 per 1,000 females.

Among males, the 1950 rate (116.8) is less than 1 percent below the 10-year average (117.7). For certain causes of disability, however, greater changes in frequency may be noted. The 1950 rates for the following causes are more than 25 percent above their 10-year averages: cancer, 83 percent above; diseases of the heart, 32 percent; diseases of genitourinary system, 31 percent; hernia, 29 percent; and other diseases of nervous system, 28 percent. Diseases occurring more than 25 percent below the 10-year averages are: influenza and grippe, 36 percent below; diseases of pharynx and tonsils, 33 percent; and tuberculosis of the respiratory system, 29 percent.

Among females, the 1950 rate (258.4) is 13 percent above the 10-year average (229.3). Attention is directed to the increase in the rate for cancer, and the decrease in tuberculosis of the respiratory system.

Postwar Down-trend. A downward trend of male sickness absenteeism began in the postwar period; the absenteeism rate for 1950, however, is somewhat above the rate for 1949 and

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Table 1. *Annual number of absences per 1,000 persons on account of sickness and nonindustrial injuries disabling for 8 consecutive calendar days or longer, by cause; experience of male and female employees in various industries, 1950, 1949, and 1941–50, inclusive* [1]

Cause [2]	Males 1950	Males 1941–50 [3]	Males 1949	Females 1950	Females 1941–50 [3]	Females 1949
Sickness and nonindustrial injuries	116.8	117.7	95.5	258.4	229.3	254.5
Percent of female rate	45	51	38	--------	--------	--------
Percent of male rate	--------	--------	--------	221	195	266
Nonindustrial injuries (169–195)	13.7	12.1	10.9	19.3	16.2	18.5
Sickness	103.1	105.6	84.6	239.1	213.1	236.0
Respiratory diseases	34.1	43.2	27.0	106.1	93.8	98.2
Tuberculosis of respiratory system (13)	.5	.7	.7	.2	.5	.9
Influenza, grippe (33)	10.9	17.0	8.0	30.7	31.9	24.6
Bronchitis, acute and chronic (106)	5.9	6.9	4.4	11.6	10.7	12.1
Pneumonia, all forms (107–109)	5.4	5.1	4.0	5.4	3.5	5.5
Diseases of pharynx and tonsils (115b, 115c)	3.2	4.8	3.4	13.1	15.7	15.9
Other respiratory diseases (104, 105, 110–114)	8.2	8.7	6.5	45.1	31.5	39.2
Digestive diseases	20.1	17.9	16.8	28.5	30.3	27.9
Diseases of stomach except cancer (117, 118)	6.2	5.7	5.3	3.7	3.4	3.6
Diarrhea and enteritis (120)	2.6	2.2	2.1	7.3	5.8	6.9
Appendicitis (121)	4.1	4.2	3.5	7.2	12.3	7.8
Hernia (122a)	3.1	2.4	2.7	1.0	.6	.5
Other digestive diseases (115a, 115d, 116, 122b–129)	4.1	3.4	3.2	9.3	8.2	9.1
Nonrespiratory-nondigestive diseases	45.3	40.9	38.5	100.4	84.2	105.3
Infectious and parasitic diseases (1–12, 14–24, 26–29, 31, 32, 34–44)[4]	3.0	2.6	2.2	9.8	6.0	9.2
Cancer, all sites (45–55)	1.1	.6	.8	1.1	.6	.8
Rheumatism, acute and chronic (58, 59)	3.6	4.5	3.8	4.5	4.3	5.2
Neurasthenia and the like (part of 84d)	1.5	1.8	1.6	12.2	11.3	11.1
Neuralgia, neuritis, sciatica (87b)	2.1	2.6	2.0	3.3	2.9	3.8
Other diseases of nervous system (80–85, 87, except part of 84d, and 87b)	2.3	1.8	1.8	3.7	1.9	3.0
Diseases of heart (90–95)	5.4	4.1	4.4	2.3	2.3	3.0
Diseases of arteries and high blood pressure (96–99, 102)	2.3	2.0	2.0	1.6	1.3	1.4
Other diseases of circulatory system (100, 101, 103)	4.8	3.9	3.8	6 7	5.7	8.0
Nephritis, acute and chronic (130–132)	.4	.4	.4	.3	.4	.6
Other diseases of genitourinary system (133–139)	4.2	3.2	3.3	23.5	19.0	26.5
Diseases of skin (151–153)	3.6	3.4	3.1	5.3	5.4	5.6
Diseases of organs of movement except diseases of joints (156b)	3.5	3.4	2.8	7.4	5.5	7.5
All other diseases (56, 57, 60–79, 88, 89, 154, 155, 156a, 157, 162)	7.5	6.6	6.5	18.7	17.6	19.6
Ill-defined and unknown causes (200)	3.6	3.6	2 3	4.1	4.8	4.6
Average number of persons	173,881	2,384,914	210,494	14,113	215,267	15,116

[1] Industrial injuries and venereal diseases are not included.
[2] Numbers in parentheses are disease title numbers from International List of Causes of Death, 1939.
[3] Average of the 10 annual rates.
[4] Exclusive of influenza and grippe, respiratory tuberculosis, and venereal diseases.

may be the beginning of an upswing. This increase in frequency was participated in by each of the broad cause groups: respiratory diseases, nonrespiratory-nondigestive diseases, digestive diseases, and nonindustrial injuries. The female rate in the postwar period, on the other hand, has described generally a level trend with only a slight increase in the rate for 1950. The increase in sickness frequency during 1950 is in agreement with past experiences when higher sickness rates occurred in periods of increased industrial activity.

Index of the Reports, 1920–50. To expedite the locating of a particular number of the PUBLIC HEALTH REPORTS covering industrial sickness for a definite period of time, the following chronological index is presented:

Time period covered	Public Health Reports, date of issue	Time period covered	Public Health Reports, date of issue
First 6 months, 1920	Dec. 3, 1920	Years 1921–38, by triennia	May 31, 1940
First 9 months, 1920	Mar. 4, 1921	First quarter, 1939	Aug. 25, 1939
Year 1920	July 1, 1921	Second quarter, 1939	Oct. 20, 1939
January 1920-June 1921	Jan. 6, 1922	Third quarter, 1939	Jan. 5, 1940
Year 1921	Dec. 29, 1922	Fourth quarter, 1939	Apr. 12, 1940
Years 1920–23	Oct. 31, 1924	Year 1939	Aug. 2, 1940
Years 1922–24	Jan. 22, 1926	First quarter, 1940	Aug. 2, 1940
Years 1921–27	Feb. 22, 1929	Second quarter, 1940	Nov. 15, 1940
Years 1921–28	Jan. 17, 1930	Third quarter, 1940	Dec. 27, 1940
First quarter, 1929	Sept. 13, 1929	Fourth quarter, 1940 (with index)	Apr. 11, 1941
Second and third quarters, 1929	Feb. 14, 1930	Year 1940	Sept. 12, 1941
Fourth quarter, 1929	May 23, 1930	First quarter, 1941	Sept. 12, 1941
First and second quarters, 1930	Oct. 24, 1930	Second quarter, 1941	Oct. 17, 1941
Third and fourth quarters, 1930	Apr. 3, 1931	Third quarter, 1941	Dec. 19, 1941
First quarter, 1931	July 31, 1931	Fourth quarter, 1941	Apr. 17, 1942
Second quarter, 1931	Oct. 16, 1931	Year 1941	Sept. 4, 1942
Third quarter, 1931	Jan. 15, 1932	First quarter, 1942	Sept. 4, 1942
Fourth quarter, 1931	Apr. 29, 1932	Second quarter, 1942	Oct. 23, 1942
Years 1921–31	Apr. 29, 1932	Third quarter, 1942	Feb. 5, 1943
First quarter, 1932	July 15, 1932	Fourth quarter, 1942	Apr. 23, 1943
Second quarter, 1932	Nov. 25, 1932	Years 1933–42	Aug. 13, 1943
Third quarter, 1932	Dec. 16, 1932	First quarter, 1943	Aug. 20, 1943
Fourth quarter, 1932	Mar. 31, 1933	Second quarter, 1943	Dec. 24, 1943
Years 1927–32	July 28, 1933	Third quarter, 1943	Mar. 17, 1944
First quarter, 1933	July 7, 1933	Fourth quarter, 1943	May 12, 1944
Second quarter, 1933	Sept. 29, 1933	Year 1943	Sept. 29, 1944
Third quarter, 1933	Jan. 12, 1934	First and second quarters, 1944	Sept. 29, 1944
Fourth quarter, 1933	Mar. 30, 1934	Third quarter, 1944	Feb. 9, 1945
Years 1928–33	May 25, 1934	Fourth quarter, 1944	June 1, 1945
First quarter, 1934	June 29, 1934	Year 1944	Sept. 7, 1945
Second quarter, 1934	Oct. 19, 1934	First quarter, 1945	Sept. 7, 1945
Third quarter, 1934	Jan. 25, 1935	Second quarter, 1945	Oct. 5, 1945
Fourth quarter, 1934	Apr. 26, 1935	Third and fourth quarters, 1945	July 26, 1946
Years 1929–34	Nov. 1, 1935	Year 1945	Nov. 8, 1946
First quarter, 1935	Aug. 23, 1935	First quarter, 1946	Nov. 15, 1946
Second quarter, 1935	Nov. 15, 1935	Second and third quarters, 1946	Feb. 21, 1947
Third quarter, 1935	Jan. 31, 1936	Fourth quarter, 1946	July 25, 1947
Fourth quarter, 1935	May 22, 1936	Years 1937–46	Oct. 24, 1947
Years 1930–35	Jan. 1, 1937	First and second quarters, 1947	Dec. 19, 1947
First quarter, 1936	July 24, 1936	Third and fourth quarters, 1947	May 21, 1948
Second quarter, 1936	Dec. 4, 1936	Year 1947	Nov. 12, 1948
Third quarter, 1936	Jan. 29, 1937	First and second quarters, 1948	Nov. 12, 1948
Fourth quarter, 1936	Apr. 30, 1937	Third and fourth quarters, 1948	May 20, 1949
Years 1931–36	Sept. 17, 1937	Year 1948	Oct. 28, 1949
First quarter, 1937	Aug. 27, 1937	First and second quarters, 1949	Oct. 28, 1949
Second quarter, 1937	Oct. 29, 1937	Third and fourth quarters, 1949	June 23, 1950
Third quarter, 1937	Jan. 14, 1938	Year 1949	Nov. 24, 1950
Fourth quarter, 1937	Apr. 8, 1938	First and second quarters, 1950	Nov. 24, 1950
Years 1932–37	Sept. 2, 1938	Third and fourth quarters, 1950	June 15, 1951
First quarter, 1938	Sept. 2, 1938	Year 1950	Present report
Second quarter, 1938	Oct. 28, 1938		
Third and fourth quarters, 1938	Apr. 28, 1939		

REFERENCES:

(1) Gafafer, W. M.: Industrial sickness absenteeism. Males and females, 1949, and males, first and second quarters, 1950. Pub. Health Rep. **65:** 1556–1561 (1950).

(2) Gafafer, W. M.: Industrial sickness absenteeism, third and fourth quarters, 1950. Pub. Health Rep. **66:** 779–780 (1951).

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports from States for Week Ended November 3, 1951

In the United States meningococcal meningitis has been occurring in epidemic waves at intervals of 6 to 12 years during the past five decades. Since 1925 there have been three major epidemic periods centering in the years 1929, 1935, and 1943. Following 1943 there was a steady decrease in the numbers of cases and deaths, but in 1950 there was a slightly greater number of cases than for the preceding year. The number reported (3,495) for the first 44 weeks of 1951 is in excess of that (3,207) for the same period of 1950. This suggests that another period of increased incidence of meningococcal meningitis may be in the offing.

Between 1925 and 1930 there were two cases reported for every death registered. The advent of sulfonamide therapy after 1935 had little effect on the ratio. During the epidemic wave of 1943 and 1944, the ratio of cases to deaths increased to 6:1, but since that time the number of cases reported for each death has decreased to about 4:1. The institution of new and better therapeutic agents and possibly an improvement in completeness of reporting probably have been the most important factors in the changes in ratio of cases to deaths.

Since the seasonal low point of the disease early in September, the proportion of cases which have been reported in the various geographical regions has corresponded generally with the distribution of population—i. e., there has been no concentration of cases in any one part of the country except for the East South Central States. Tennessee has reported a large proportion of the cases.

Of the 34 cases of malaria in civilians, 24 were reported by Wisconsin. A civilian case, reported previously by Missouri for the week ended September 22, upon investigation was found to be a vivax type of infection. The patient had no previous history of malaria and had not been outside Missouri during her lifetime. She had not been more than 15 miles from her home in St. Louis during the past 2 years. Information on 121 cases of malaria reported in Texas for the first 6 months of 1951 indicates that 32 were confirmed by examination of blood smears.

Gastroenteritis

Dr. M. B. Goodman, New York State Health Department, has reported an outbreak of gastroenteritis among employees of an industrial plant located on Long Island. Some had an illness in which gastrointestinal symptoms predominated, and others had acute upper respiratory infection. Cases were evenly distributed throughout the various shops. Most of the cases had their onset within a period of 3 days. No explosive characteristics were noted, and person-to-person contact is regarded as the mode of spread.

Dr. Goodman reported an outbreak of Sonne dysentery which occurred in a State hospital. Sixty patients out of a susceptible population of 140 developed symptoms of diarrhea over a period of 3 weeks. A Sonne type of organism was cultured from the stools of 17. All patients were given a course of sulfadiazine. There were no fatalities. No common source of infection was found.

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Nov. 3, 1951	Nov. 4, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	1	------	------	(1)	(1)	(1)	(1)	50	40	43
Diphtheria (055)	138	171	322	27th	1,349	1,877	3,372	3,357	5,005	7,983
Encephalitis, acute infectious (082)	16	25	15	(1)	(1)	(1)	(1)	[2] 903	841	560
Influenza (480–483)	431	868	868	30th	4,445	6,912	6,912	120,500	145,676	133,876
Measles (085)	2,085	1,315	1,261	35th	[3] 11,384	7,120	7,018	[3] 480,295	295,291	562,393
Meningitis, meningococcal (057.0)	76	41	48	37th	434	408	401	3,495	3,207	2,977
Pneumonia (490–493)	706	1,169	(4)	(1)	(1)	(1)	(1)	51,753	69,921	(4)
Poliomyelitis, acute (080)	803	1,089	879	11th	[5] 24,353	27,777	24,022	[5] 25,565	28,908	24,372
Rocky Mountain spotted fever (104)	2	------	2	(1)	(1)	(1)	(1)	320	445	538
Scarlet fever (050) [6]	860	892	1,270	32d	5,719	6,207	8,120	59,105	46,377	64,234
Smallpox (084)	1	2	------	35th	2	3	4	13	29	51
Tularemia (059)	8	11	11	(1)	(1)	(1)	(1)	559	778	820
Typhoid and paratyphoid fever (040, 041) [7]	64	71	71	11th	2,276	2,542	2,930	2,711	3,051	3,415
Whooping cough (056)	1,216	1,673	1,673	39th	4,999	7,582	7,582	58,774	104,777	83,800

[1] Not computed.
[2] Addition: North Carolina, week ended October 20, 1 case.
[3] Addition: Iowa, week ended October 20, 4 cases.
[4] Data not available.
[5] Addition—Iowa, 7 cases, not allocated. Deduction—North Carolina, week ended October 20, 1 case.
[6] Including cases reported as streptococcal sore throat.
[7] Including cases reported as salmonellosis.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Nov. 3, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**138**	**16**	**431**	**2,085**	**76**	**706**	**803**
New England	**5**		**2**	**248**	**3**	**31**	**7**
Maine	2		2	55	2	16	
New Hampshire				21			
Vermont				29			
Massachusetts	3			103			2
Rhode Island				16	1		1
Connecticut				24		15	4
Middle Atlantic	**5**	**8**	**5**	**686**	**15**	**91**	**79**
New York	4	8	(1)	405	4		53
New Jersey			5	123	4	48	13
Pennsylvania	1			158	7	43	13
East North Central	**7**	**1**	**24**	**531**	**20**	**64**	**168**
Ohio	4			110	2		38
Indiana	3		20	12		5	4
Illinois		1	2	124	5	43	32
Michigan			2	219	4	16	49
Wisconsin				66	9		45
West North Central	**10**	**2**	**6**	**50**	**5**	**78**	**121**
Minnesota	6			9	2	11	23
Iowa	1			3	1		8
Missouri	3	1			2	1	46
North Dakota		1	5	16		59	6
South Dakota				4			1
Nebraska				16			9
Kansas			1	2		7	28
South Atlantic	**53**	**1**	**21**	**199**	**11**	**123**	**44**
Delaware				1	4		1
Maryland			1	87	3	29	1
District of Columbia				15		10	1
Virginia	9			21		41	4
West Virginia	5			32	1		14
North Carolina	18			2	1		4
South Carolina	6		2	2		1	1
Georgia	14		18	28	2	42	17
Florida	1	1		11			1
East South Central	**31**			**28**	**7**	**27**	**61**
Kentucky	3			5	1		
Tennessee	7			6	2		22
Alabama	15			6	1	18	16
Mississippi	6			11	3	9	23
West South Central	**19**		**151**	**29**	**9**	**184**	**71**
Arkansas	4		107	4	2	28	8
Louisiana	1		3			13	8
Oklahoma	4		41	1	1	13	9
Texas	10			24	6	130	46
Mountain	**3**		**127**	**159**		**60**	**83**
Montana	1		14	31			5
Idaho				4			14
Wyoming						3	12
Colorado			3	8		11	19
New Mexico	1			55		32	13
Arizona	1		110	35		14	7
Utah				26			12
Nevada							1
Pacific	**5**	**4**	**95**	**155**	**6**	**48**	**169**
Washington	1		66	28			18
Oregon	1		11	31	2	17	26
California	3	4	18	96	4	31	125
Alaska							
Hawaii			29	433		1	

New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Nov. 3, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	2	860	1	8	64	1,216	122
New England		55			11	211	
Maine		4			1	6	
New Hampshire		1				11	
Vermont		1				94	
Massachusetts		38			10	95	
Rhode Island		1				1	
Connecticut		10				4	
Middle Atlantic		125			3	196	24
New York		71				82	19
New Jersey		21				58	
Pennsylvania		33			3	56	5
East North Central		234	1		8	269	7
Ohio		74	1		3	64	2
Indiana		14				12	
Illinois		35				45	3
Michigan		86			3	101	2
Wisconsin		25			2	47	
West North Central		54		2	6	48	16
Minnesota		17				1	13
Iowa		12			1	6	
Missouri		12		2	5	12	1
North Dakota						4	
South Dakota							
Nebraska		4				10	2
Kansas		9				15	
South Atlantic	1	135			11	104	15
Delaware		1				1	
Maryland		17			1	6	
District of Columbia		9				6	
Virginia		21			5	23	2
West Virginia		8				18	1
North Carolina	1	58			1	25	
South Carolina		3				2	4
Georgia		14			4	8	8
Florida		4				15	
East South Central		73		1	2	47	33
Kentucky		19				18	14
Tennessee		47				21	9
Alabama		5			1	6	6
Mississippi		2		1	1	2	4
West South Central		17		3	9	146	25
Arkansas		3		2	1	12	1
Louisiana		1			3	1	
Oklahoma		5			1	16	4
Texas		8		1	4	117	20
Mountain		38		1	6	118	1
Montana		7		1	3	10	
Idaho		9				7	
Wyoming		4					1
Colorado		6			1	15	
New Mexico		3			2	81	
Arizona		1				5	
Utah		8					
Nevada							
Pacific	1	129		1	8	77	1
Washington		14				4	
Oregon	1	14					
California		101		1	8	73	1
Alaska		4				1	
Hawaii					1		

[1] Including cases reported as streptococcal sore throat [2] Including cases reported as salmonellosis.
Anthrax: California, 1 case. *Psittacosis:* New York City, 2 cases.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Oct. 20, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	6					2	3				1
Chickenpox	609	5		11	4	144	212	22	35	66	110
Diphtheria	8				3	5					
Dysentery, bacillary	10					3					7
Encephalitis, infectious	2							1	1		
German measles	78	3		2		20	11		1	25	16
Influenza	20			17			3				
Measles	518	3		15	2	102	89	12	9	126	160
Meningitis, meningococcal	7	1				1	1	1			3
Mumps	278	3		8	3	42	145	10	22	13	32
Poliomyelitis	74			4	4	17	32	6	3	4	4
Scarlet fever	258	2			1	56	32	32	16	19	100
Tuberculosis (all forms)	343	[1] 101		7	23	100	17	6	8	34	47
Typhoid and paratyphoid fever	8				1	5				2	
Venereal diseases:											
Gonorrhea	301	8		6	21	49	58	28	17	37	77
Syphilis	81	1		5	4	42	15	2	3		9
Primary	6					3	2	1			
Secondary	7				1	5		1			
Other	68	1		5	3	34	13		3		9
Other forms	1										1
Whooping cough	227			1		93	70	9	11	32	11

[1] Includes cases discovered in a recent survey.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Smallpox

Cameroon (French). For the period October 1–10, 68 cases (22 deaths) of smallpox were reported in the Benoue Region.

Ceylon. During the week ended October 20, nine cases of smallpox were reported in the Western Province as compared with four for the previous week.

French West Africa. For the period October 11–20, Dahomey and Ivory Coast reported 49 and 12 cases of smallpox, respectively.

Tanganyika. During the week ended October 13, nine cases of smallpox were reported in the seaport of Dar-es-Salaam.

Togo (*French*). During the period October 1–10, nine cases of smallpox were reported in Anecho.

Typhus Fever

Iraq. For the week ended October 27, two cases of typhus fever were reported in Baghdad.

Japan. One case of typhus fever was reported in Japan for the week ended September 15.

Turkey. Four cases of typhus fever were reported in Turkey for the week ended October 27.

Yellow Fever

French West Africa. The suspected case of yellow fever previously reported in Bembereke, Dahomey, was not confirmed.

Gold Coast. On September 5, one case of yellow fever was reported in Suhum. A fatal suspected case was reported in Tarkwa on October 12. The fatal suspected case reported in Accra on September 19, was not confirmed.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price per year—$4.75, domestic; $6.25, foreign

Public Health Reports

VOLUME 66 **NOVEMBER 30, 1951** NUMBER 48

[To be published monthly in 1952—see back cover]

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FEDERAL SECURITY AGENCY
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Division of Public Health Methods
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Mental Health Clinic Services for Children in the United States, 1950

By Maryland Y. Pennell, M.Sc.Hyg., Dale C. Cameron, M.D., and Morton Kramer, D.Sc.Hyg.*

More than 1,200 mental health clinics are now in operation in the United States, three-quarters of them partly or entirely devoted to serving children. During 1950, these clinics saw at least 150,000 child patients.

A survey of these clinics was undertaken in the spring and summer of 1950 to obtain information on psychiatric clinic services for children for use by the Mid-Century White House Conference on Children and Youth held in December 1950. The State committees established in connection with the conference performed an important service as focal points for the collection of data from clinics in each State, by distributing, following up, and collecting the completed questionnaires. With the exception of one final query sent from Washington, all data in this study were obtained in this way.

The list of clinics to which questionnaires were addressed was obtained from the following sources: the 1948 Directory of Psychiatric Clinics in the United States (*1*); the National Institute of Mental Health list of clinics receiving assistance from Federal grant-in-aid funds; the directory of the American Hospital Association (*2*), and additional names suggested at the State level.

Although children may receive psychiatric service from private practitioners, in well-child conferences, and in general pediatric clinics, as well as in children's mental hygiene clinics and in general psychiatric clinics, only the last two types of clinic service are included in this study. No attempt was made to determine the number of children receiving service from psychiatrists in private practice, but it is presumed to be small. In well-child conferences, the service offered is largely preventive and takes the form of having a psychiatrist or psychologist available for consultation with the staff or with the parents. Such service is offered by relatively few agencies, those that

*From the Division of Public Health Methods and the National Institute of Mental Health, Public Health Service. The material in this paper is based upon data collected in connection with the fact-finding work of the Mid-Century White House Conference on Children and Youth.

provide less than one-fifth of the well-child sessions, according to the findings of the pediatrics study (*3*, *4*). Data are not available on the number of emotionally handicapped children seen in general pediatric clinics; often these children are referred to psychiatric clinics.

Number of Clinics

How to define and count clinics is one of the major problems of this type of survey. In the current study, a clinic is defined as any place where psychiatric out-patient service is offered to nonprivate ambulatory patients at regularly scheduled intervals. The counting of stationary clinics is simple; these, whether operating on a full- or part-time basis, are counted individually. The counting of traveling clinics is more complex since they may have regularly scheduled sessions at certain outlets (locations) where patients are seen by special arrangement only. The regularly scheduled outlets for which separate records are kept are counted as individual clinics; the outlets by appointment only, where the towns covered vary from year to year and no statistics are available for each location, are combined and considered to be one clinic.[1]

When the above definitions were applied to the data collected, 1,228 clinics were found to be operating in the continental United States in the summer of 1950. This is equivalent to 0.81 clinics per 100,000 population. Applying the same definitions to data collected in 1947 (*5*), we find about 850 clinics in operation in that year, almost 100 of which were discontinued by 1950.[2] The net increase of about 475 clinics is clearly a striking development.

Of the 1,228 clinics operating in 1950, 902, or 73 percent, reported that they served children. Among the rest, 256 specified that they did not serve children and 70 did not report on this point.

About one-third of the reporting clinics serve children only. A few of these clinics, in children's hospitals, specified that all of their patients were under 10 years of age. Less than 1 clinic in 10 stated that children as old as 16 years were not accepted. Half of the group specified 16–18 years or "through high school" as the upper age limit. Some of the clinics stated a lower as well as an upper age limit; for example, 6 through 16 or 12 through 17. The number of adolescents actually seen in the clinics, however, is thought to be considerably less than would be indicated by these reports on admission policy. It should be remembered that clinics for children only may or may not treat parents or other adults in connection with

[1] The latter type of traveling clinic is operated by the State mental health authorities in Delaware, Indiana, Maine, and New Hampshire to serve areas not covered by existing permanent clinics. Also, one traveling school clinic in Connecticut and eight in Massachusetts are operated to serve children in the public schools of the State.

[2] The 1947 report showed a total of 481 primary clinics, maintaining 1,116 outlets on a permanent or intermittent basis.

the child. However, for the purpose of this survey, only the child was counted as a patient.

In addition to the clinics for children only, children are seen in the 44 percent of the clinics that serve both children and adults. The remaining 22 percent of the total reported that they serve adults only. Included in this group, however, are the Veterans Administration clinics which serve some persons under 21 years of age.

Distribution

Despite the variations in clinic practice and patient-load, the number of clinics can be used to indicate the uneven distribution of services within the United States. More than half of the clinics are located in the Northeast, a region which contains only about one-quarter of the total population. The ratio of 1.67 clinics per 100,000 population for this region is more than four times that for the South, as shown below:

Region	Number of clinics	Percent of clinics	Clinics per 100,000 population *
Northeast	659	53	1. 67
North Central	267	22	. 60
South	182	15	. 39
West	120	10	. 61
United States	1, 228	100	. 81

Further details of clinic distribution, including State-by-State figures, are given in table 1.

When the States are ranked according to the number of clinics in relation to population, as shown in figure 1, eight of the nine Northeastern States are in the top quartile. Delaware and the District of Columbia in the South Atlantic Division and Montana and Colorado in the Mountain Division are also in the high-ranking group. At the other end of the scale are the three States which have no operating clinics—Idaho, Nevada, and Wyoming, all in the Mountain Division.[3] The other low-ranking States, with the exceptions of North Dakota and South Dakota, are in the South.

Almost half of all clinics are located in the 106 cities having 100,000 or more inhabitants in 1950 (*6*). Many of these clinics draw patients from beyond the city in which they are located, but no measure of such service is available. For the United States as a whole, twice as many clinics in relation to population are located in large metro-

[3] In 1947, five States had no clinics in operation. South Dakota and Utah have subsequently developed some service.

Table 1. *Mental health clinics, according to provision of service for children and number of child patients served, by geographic division and State, 1950*

Division and State	All clinics in operation [1]: Number	All clinics in operation [1]: Number per 100,000 population [2]	Number of clinics: Reporting they— Do not serve children	Number of clinics: Reporting they— Serve children	Number of clinics: No reports submitted	Child patients seen during survey year: Number	Child patients seen during survey year: Number per 1,000 children [3]
United States [4]	1,228	0.81	256	902	70	149,002	3.29
New England	153	1.64	22	118	13	19,894	7.73
Maine	12	1.31	0	10	2	355	1.24
New Hampshire	22	4.13	5	16	1	1,570	10 40
Vermont	10	2.65	0	10	0	782	6.74
Massachusetts	60	1.28	9	45	6	12,314	9.70
Rhode Island	14	1.77	3	11	0	906	4 40
Connecticut	35	1.74	5	26	4	3,967	7.25
Middle Atlantic	506	1.68	90	390	26	52,144	6.55
New York	361	2.43	73	266	22	36,680	9.9
New Jersey	64	1.32	7	56	1	8,494	6.81
Pennsylvania	81	.77	10	68	3	6,970	2.31
East North Central	191	.63	58	123	10	27,749	3 1
Ohio	34	.43	6	27	1	8,181	3.5
Indiana	13	.33	6	6	1	1,169	.9
Illinois [5]	69	.79	32	33	4	5,568	2.4
Michigan	53	.83	11	39	3	9,100	4.6
Wisconsin	22	.64	3	18	1	3,731	3.6
West North Central	76	.54	21	49	6	8,747	2.1
Minnesota	18	.60	6	10	2	3,452	3.8
Iowa	14	.53	4	10	0	1,285	1 6
Missouri	21	.53	6	13	2	2,012	1.7
North Dakota	1	.16	0	1	0	156	.7
South Dakota	1	.15	0	1	0	34	.1
Nebraska	11	.83	1	8	2	318	.8
Kansas	10	.52	4	6	0	1,490	2.6
South Atlantic	114	.54	24	87	3	12,657	1.8
Delaware	7	2.20	0	7	0	614	6.8
Maryland	21	.90	4	17	0	2,970	4.5
District of Columbia	16	2.00	5	11	0	1,904	8.7
Virginia	18	.54	3	15	0	2,152	2.0
West Virginia	9	.45	1	8	0	511	.7
North Carolina	19	.47	5	13	1	1,484	1.0
South Carolina	4	.19	1	2	1	386	.4
Georgia	9	.26	3	5	1	880	.7
Florida	11	.40	2	9	0	1,756	2.2
East South Central	37	.32	7	30	0	2,749	.6
Kentucky	12	.41	3	9	0	1,381	1.
Tennessee	8	.24	3	5	0	766	.6
Alabama	3	.10	1	2	0	167	.
Mississippi	14	.64	0	14	0	435	.
West South Central	31	.21	8	21	2	5,004	1.
Arkansas	2	.10	1	1	0	150	.
Louisiana	10	.37	2	8	0	1,843	1.
Oklahoma	6	.27	1	5	0	960	1.
Texas	13	.17	4	7	2	2,051	.
Mountain	29	.57	9	20	0	3,699	2.
Montana	7	1.18	0	7	0	1,775	10.
Idaho	0	0	0	0	0	0	
Wyoming	0	0	0	0	0	0	
Colorado	14	1.06	4	10	0	1,485	3.
New Mexico	2	.29	1	1	0	230	.
Arizona	2	.27	1	1	0	130	.
Utah	4	.58	3	1	0	79	.
Nevada	0	0	0	0	0	0	
Pacific	91	.63	17	64	10	16,359	3.
Washington	7	.30	1	6	0	2,467	3.
Oregon	14	.92	1	13	0	900	1.
California	70	.66	15	45	10	12,992	4.

[1] Outlets of primary clinics and regularly scheduled outlets of traveling clinics for which separate records are kept are counted as clinics. Traveling clinics and their outlets by appointment are counted as one clinic.

[2] Rates based on population reported in the 1950 census.

[3] Rates based on population under 18 years of age, estimated as of July 1, 1948, by the Bureau of the Census.

[4] Exclusive of the Territories which reported as follows: Alaska—no clinic service; Hawaii—5 clinics cared for about 375 child patients during the past year; Puerto Rico—7 clinics were reported as providing psychiatric service. Only 5 served children, with about 700 child patients during the past year. Two of these clinics saw private patients only; a third had no psychiatrists but referred cases for free treatment to private psychiatrists on a voluntary basis; Virgin Islands—no clinic service.

[5] Exclusive of the service of the Institute for Juvenile Research which is not always given through clinics. The Institute saw 725 children for diagnostic service during the 10-month period ending May 1950.

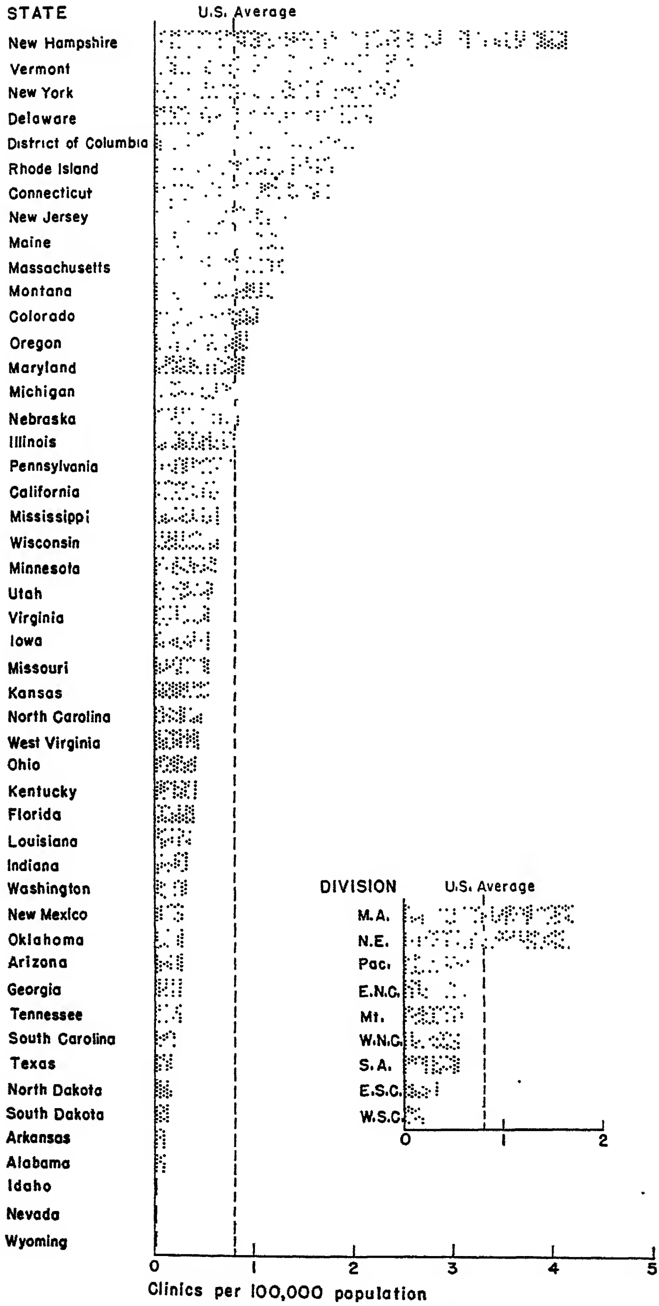

Figure 1. Number of mental health clinics per 100,000 population by division and State, 1950.

politan centers as in smaller cities and rural areas, as shown in the following tabulation:

Region	Clinics per 100,000 population		
	In cities of 100,000 or more population	In smaller cities and rural areas	Total
Northeast	1. 78	1 59	1. 67
North Central	. 99	. 44	. 60
South	. 90	. 27	. 39
West	1. 20	. 36	. 61
United States	1. 29	. 62	. 81

In the Northeast region, both the metropolitan and nonmetropolitan rates are high. In the other three regions the concentration of clinics in large cities shows marked contrast to service available in nonmetropolitan areas.

Sponsorship

About 60 percent of all clinics are the responsibility of State, county, or city health and welfare agencies. Together with other officially sponsored clinics, including those connected with courts (2 percent), school systems (5 percent), and the Veterans Administration (6 percent), these make up three-quarters of all clinics. The remaining 27 percent of the clinics are under sponsorship of voluntary welfare agencies, mental hygiene societies, and other nonofficial organizations.

Location

It is assumed that the services of a mental health clinic ideally should be integrated with other health services—preventive, diagnostic, and therapeutic. The present study does not tell how many clinics provide such integrated service. The location of the clinic gives only limited insight into this question. If the clinic is located in a health center, general hospital, or mental hospital, integration with other health services provided at that location can be accomplished with relative ease. In fact, educational contact of psychiatric workers with other health and medical personnel is often almost inevitable where there is joint housing of mental health and other health services.

About two-thirds (63 percent) of the mental health clinics are operated primarily outside of hospital settings. Less than one-fourth (23 percent) of the clinics are located in general hospitals, and 14

percent are in mental hospitals. This tabulation does not include the Veterans Administration clinics which do not provide community service.

This information does not indicate, of course, whether the nonhospital clinics are affiliated with psychiatric departments of hospitals. We must also note that the clinics in general hospitals are not necessarily operated by that hospital's staff. They may be operated by an official or nonofficial agency which runs the clinic as a separate entity in space provided by the hospital.

Although only 14 percent of the clinics are located in mental hospitals, a much larger proportion—one-third—are operated by the same State department that is responsible for the operation of the mental hospitals. These clinics often use the mental hospital staff to operate a clinic outside that hospital, with or without supplementary staff furnished locally. In certain instances, such a clinic is set up for the care of patients furloughed or discharged from mental hospitals. Sometimes the clinic offers diagnostic service only; treatment is given in the parent institution. In many instances, these clinics provide diagnostic and therapeutic services on a broad community basis without special reference to mental hospital patients or facilities. This is true of all the State mental health clinics in Illinois, Michigan, and Montana, and most of those in New York, New Jersey, and Pennsylvania.

Number of Children Served

For a more adequate estimate of clinic services for children, information is needed on the actual number of patients under age 21 (or 18) that are seen over a period of time. Ideally, this information should be available by age groups, but few clinics are able to furnish such statistics. For many clinics serving both children and adults, it was necessary to compute the number of children served from the estimated proportion of children among the total number of patients. Many of these mixed clinics specify a lower age limit, for example, 16 years of age, and could only approximate the number of patients aged 16 to 21. As an additional source of error, it may be pointed out that in the urban areas some duplication of children seen in several clinics may occur.[4]

The 902 clinics reporting services to children served a total of 149,002 child patients during a 1-year period in 1949–50, or 3.3 child patients per 1,000 population under the age of 18 (table 1). As an additional 70 clinics did not report whether or not they served children, it may be assumed that the actual number was somewhat higher, perhaps as high as 155,000 child patients seen annually.

[4] It was impossible to obtain a reasonable estimate of number of visits by child patients. Few clinics keep records which permit computation of the gross number of patient-visits per year, even without breakdown into age groups.

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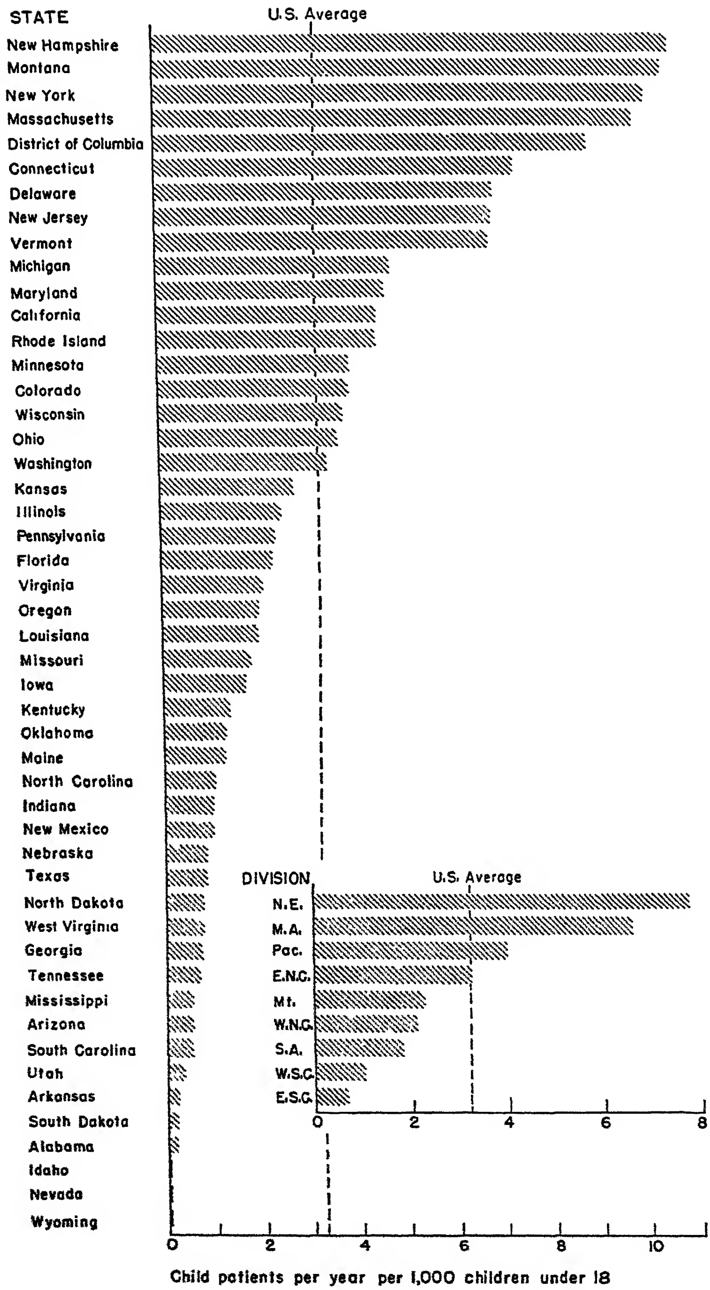

Figure 2. Number of child patients in mental health clinics during one year (1949-50) per 1,000 children under 18, by division and State.

States having the highest ratio of clinics to total population also tend to serve the largest number of children in relation to the child population. (Compare figures 1 and 2.) Seven of the nine Northeastern States are in the top quartile of child patients seen during the survey year. New Hampshire and Montana, with more than 10 patients per 1,000 children, are the highest ranking States.

Some States still have little or no psychiatric service for children. Five of the Mountain States are in the lowest quartile, along with South Dakota and several Southern States. Idaho, Wyoming, and Nevada reported no service to children.

Regional comparisons indicate that five times as many children per 1,000 are seen annually in clinics in the Northeast as in the South, the other regions falling in between, as shown in the following summary:

Region	*Child patients per 1,000 children*
Northeast	6.8
North Central	2.8
South	1.3
West	3.5
United States	3.3

We may note from figure 2 that, within the Western region, almost twice as many children per 1,000 were seen in the Pacific States (4.0) as in the Mountain States (2.2).

Nonofficially sponsored clinics provide almost one-third of the child clinic care in the United States. In the two South Central divisions they provide half the service; in the Mountain division, only about one-tenth. Official judiciary and educational agencies account for one-fourth of the total served; official health and welfare agencies, for somewhat less than half. One-third of the States reported service by the official health-welfare agency only; in the Mountain division three-fourths of the child patients are so served, in contrast to about one-fourth in the Middle Atlantic and Pacific sections.

Characteristics of Clinics Serving Children

More detailed information on clinic hours, staff, and type of service was reported by 762 clinics, which served about 129,000 child patients during the survey year. It is recognized that the better-staffed full-time clinics would be more likely to complete the one-page questionnaire. How representative these data are for all clinics cannot be stated, but at least they describe clinics that serve almost 9 out of every 10 child patients.

Clinic Hours. An attempt was made through two questions to find out how many clinics operated full time. One question asked

for the schedule of clinic activities current during the 4-week period from May 7 to June 3, 1950. The other asked for the number of man-hours devoted to all clinic activities by each type of professional worker during the same period. As might be expected, the replies were not always consistent. For example, where there is a social worker on a full-time basis, one clinic would indicate that the clinic is on a full-time basis, whereas another clinic might consider the clinic to be open only when a psychiatrist or psychologist was available. When the only full-time person is a social worker or nurse, quite a bit of her time may be spent outside of the clinic on types of work other than direct service to clinic patients. Yet it seems fair to define a full-time clinic as any clinic with at least one professional staff member on duty for 35 hours or more per week.

Forty-one percent—316 of the 762 clinics—meet this definition of full-time operation. These clinics served 79 percent of the child patients during the survey year. Approximately two-thirds of the full-time clinics have the equivalent of at least one psychiatrist on duty for 35 hours or more per week. Among the States listed in table 2, California and Ohio lead in the proportion of clinics that are full-time.

Staff. It is generally accepted that for most effective services, the mental health clinic must utilize the skills of a multidiscipline team consisting basically of a psychiatrist, a clinical psychologist, and a psychiatric social worker. The questionnaire, therefore, attempted to find out how many clinics serving children had such a basic staff during May 1950.

As shown in table 3, over two-thirds of the clinics have a complete basic staff.[5] These clinics served 83 percent of the child patients seen during the survey year. It may be noted that 87 percent of the full-time clinics, as defined above, have a basic staff, as compared to 56 percent of the part-time clinics.

The questionnaire also sought to determine whether a basic staff was available on a full-time basis, that is, all members present for as many hours a week as the clinic operated, or sufficient part-time staff present to furnish the equivalent number of man-hours per team member. For example, a full-time clinic open 40 hours per week would have a full-time basic team if there were at least 40 man-hours of service per week in each of the three basic disciplines. A part-time clinic open 20 hours a week would have a full-time basic team if the equivalent of 20 man-hours were provided in each basic discipline.

Nearly one-third of the clinics report full-time basic staffing. Another third have basic staff only part time, usually with the psychologist employed for fewest hours.

[5] In a few cases, clinics were considered to have basic staffs even if no psychiatrist was on the staff but if a psychiatrist was available for consultation. This was done only when the clinic was really a branch of a primary clinic.

Table 2. *Full-time mental health clinics serving children and child patients seen in such clinics, by State: 1950* [1]

State	Clinics			Child patients during year		
	Total number	Full-time		Total number	In full-time clinics	
		Number	Percent		Number	Percent
All clinics serving children						
United States	762	316	41	128, 897	101, 474	79
California	35	28	80	10, 611	10, 018	94
Connecticut	23	11	48	3, 751	2, 209	59
Illinois	33	15	45	5, 568	4, 179	75
Maryland	16	5	31	2, 955	1, 494	51
Massachusetts	40	21	52	11, 528	9, 692	84
Michigan	27	15	56	8, 453	8, 216	97
New Jersey	56	9	16	8, 494	4, 328	51
New York	207	58	28	28, 959	23, 479	81
Ohio	22	20	91	7, 105	7, 102	100
Pennsylvania	52	15	29	5, 589	4, 077	73
Wisconsin	16	6	38	3, 660	2, 491	68
Other States and D. C.[2]	235	113	48	32, 224	24, 189	75
Children's clinics						
United States	338	142	42	75, 446	65, 448	87
California	20	14	70	8, 371	7, 784	93
Connecticut	13	5	38	2, 427	1, 336	55
Illinois	6	4	67	1, 525	1, 411	93
Maryland	1	1	100	736	736	100
Massachusetts	25	16	64	8, 406	7, 609	91
Michigan	10	10	100	7, 672	7, 672	100
New Jersey	7	4	57	4, 293	3, 953	92
New York	168	44	26	25, 372	20, 590	81
Ohio	9	9	100	4, 404	4, 404	100
Pennsylvania	15	6	40	3, 178	2, 548	80
Wisconsin	4	1	25	913	329	36
Other States and D. C.[2]	60	28	47	8, 149	7, 076	87
Child-adult clinics						
United States	424	174	41	53, 451	36, 026	67
California	15	14	93	2, 240	2, 234	100
Connecticut	10	6	60	1, 324	873	66
Illinois	27	11	41	4, 043	2, 768	68
Maryland	15	4	27	2, 219	758	34
Massachusetts	15	5	33	3, 122	2, 083	67
Michigan	17	5	29	781	544	70
New Jersey	49	5	10	4, 201	375	9
New York	39	14	36	3, 587	2, 889	81
Ohio	13	11	85	2, 701	2, 698	100
Pennsylvania	37	9	24	2, 411	1, 529	63
Wisconsin	12	5	42	2, 747	2, 162	79
Other States and D. C.[2]	175	85	49	24, 075	17, 113	71

[1] Based on returns from the 762 (out of 902) clinics serving children that completed the questionnaire.
[2] States for which the detailed questionnaires cover fewer than 2,500 child patients.

Type of Service. Most of the 762 clinics reported that they offer full diagnostic and treatment service. About 11 percent of the clinics, serving about 9 percent of the children, reported that they provide diagnosis only. The largest proportion of diagnostic clinics, more than half, was found in New Jersey. In Massachusetts, one-quarter of the clinics reported only diagnostic service; in other States, the proportion is much smaller. A much larger proportion of the diagnostic clinics do not have a basic staff, as defined above, than the clinics providing both diagnosis and treatment.

Another important type of service is nonclinical community activity, primarily directed toward preventive measures. This may

Table 3. *Staffing of mental health clinics serving children and child patients seen in such clinics during survey year, United States: 1950*

Staffing pattern [1]	All clinics			Children's clinics			Child-adult clinics		
	Total	Full time	Part time	Total	Full time	Part time	Total	Full time	Part time
Clinics									
Number	762	316	446	338	142	196	424	174	250
Percent:	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
With basic staff full time	31.5	35.4	28.7	37.6	38.0	37.2	26.6	33.3	22.0
With basic staff part time	37.1	51.3	27.1	35.2	49.3	25.0	38.7	52.9	28.8
Without basic staff	31.4	13.3	44.2	27.2	12.7	37.8	34.7	13.8	49.2
Child Patients									
Number	128,897	101,474	27,423	75,446	65,448	9,998	53,451	36,026	17,425
Percent in clinics:	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
With basic staff full time	42.2	47.5	22.6	47.9	50.0	33.9	34.1	42.8	16.1
With basic staff part time	40.4	42.2	33.5	38.9	40.7	27.6	42.5	45.2	36.9
Without basic staff	17.4	10.3	43.9	13.2	9.3	38.5	23.4	12.0	47.0

[1] Basic staff is defined as a psychiatrist, a psychologist, and a social worker. Basic staff full time means at least one representative of each profession is on duty at all times that the clinic is in operation.

include staff service to schools, hospitals, welfare organizations, and juvenile courts, usually involving educational work for both professional and lay groups. Only a few clinics indicated that they provide such services, and many of them have no records upon which they could base an estimate of staff time devoted to these activities. A few clinics reported that they do not provide such service, while the majority apparently misunderstood the question. However, those clinics known by the authors to be providing such services answered the question clearly, evidently indicating that the wording was not too ambiguous.

Summary and Conclusions

This study was designed primarily to find out what clinical psychiatric service is available for children in the United States. Necessarily restricted to a limited description of services, it included only facts for which relatively reliable data could be obtained through a one-page questionnaire.

The amount of service provided at this time is evidently a reflection of personnel available to give such service, rather than of need or demand. For future planning, we will want to know the actual extent of such need or demand. To obtain this information, however, we must learn more about the prevalence and incidence of psychiatric disorders by age, sex, type of disorder, socioeconomic factors, and geographical distribution. Information is also needed on the kind and amount of service required by individuals in the various classifications and areas.

Several estimates have been made as to desirable clinic-population ratios. A standard quoted in the report of the National Health

Assembly in 1948 is at least one full-time clinic for psychiatric treatment for each 100,000 of the population.[6] Subsequent experience in the operation of community mental health clinics indicates that a more realistic estimate of minimum need may be one full-time clinic for each 50,000 of the population.

Since the 1,228 clinics reporting in this survey vary in staffing, hours, type of service offered, and patient load, we have not been able to use such ratios for comparing the volume and quality of service in various geographic areas. However, we can point out that the ratio for the entire United States of 0.8 clinics (of all types) per 100,000 population is inadequate to meet current demands. Furthermore, regional variations in clinic-population ratios indicate great differences in service which, to the best of our knowledge, do not reflect corresponding variations in need.

Additional information on adequacy of service in terms of quantity and quality may be deduced from such data as number of children served, clinic hours, staffing, and types of service offered.

The quantity of clinical services provided to child patients is indicated by the number of patients seen—more than 150,000 during the survey year, or 3.3 per 1,000 children in the United States. So few clinics were able to report on the number of patient-visits that the figures were not worth tabulating. The amount of time that clinics are open and the number of man-hours of service provided are also indices of the quantity of service. Only 41 percent of the clinics serving children are "full-time", but 79 percent of the children seen attend such clinics.

The only index obtained as to the quality of service has to do with the nature of the staff. It is assumed that clinics providing the integrated services of a psychiatrist, a clinical psychologist, and a psychiatric social worker are in a position to offer a better quality of service than those without such a basic staff. More than two-thirds of the clinics serving children provide such a staff. Very few have the additional benefit of the service of a pediatrician or nurse.

It has been stated that a psychiatric clinic should provide integrated preventive, diagnostic, and therapeutic services (*8*, *9*). Accordingly, an attempt was made to determine how many of the clinics provide these services. One out of nine clinics serving children provides diagnostic service only. The other 89 percent furnish treatment and it is assumed that all these provide diagnostic service, at least for the patients under treatment. No attempt was made to gather data on the kind of treatment given. Only a few clinics indicated

[6] This ratio was based on the minimum standard of 152 mental health clinic hours per month per 100,000 population, the staff for each clinic for each 100,000 population to consist of the following full-time personnel: psychiatrist, psychologist, chief psychiatric social worker, assistant psychiatric social worker, record analyst, clerk-stenographer, clerk-typist, and file clerk. These data were furnished by Dr. George S. Stevenson to Dr. Robert H. Felix in connection with the hearings on the National Neuropsychiatric Institute Act. (*7*).

that they provide nonclinical preventive services such as educational programs, discussion groups, school health, and related community activities. Granted that the question relative to such services may have been poorly formulated, the fact that those clinics known to be providing preventive service did answer seems to indicate that the majority are relatively unfamiliar with such activities. If familiarity with these activities is limited, it may be assumed that relatively little service of this kind is being provided by the clinics questioned.

One method of fostering nonclinical preventive services for communities is the joint housing of mental health clinics and general public health centers. This also fosters integration with diagnostic and treatment services, as does joint housing with other health centers, general hospitals, and some mental hospitals. However, data do not show that nonhospital clinics offer narrower or less prevention-conscious service than those in a hospital setting.

This study shows a striking increase in number of clinics over the 1947 study. However, once again it points out clearly that if we are to obtain any meaningful data on the quantity of service offered as well as its quality, a uniform record and reporting system for mental health clinics is essential. Better records are also essential to the more important study of prevalence, incidence, and causes of various psychiatric disorders.

REFERENCES

(*1*) Directory of Psychiatric Clinics in the United States and Other Resources, 1948. The National Committee for Mental Hygiene, Inc., New York, N. Y., 1948.
(*2*) Statistics and Directory Issue, Hospitals, vol. 24, No. 6, pt. II, June 1950.
(*3*) Child Health Services and Pediatric Education. Report of the Committee for the Study of Child Health Services, The American Academy of Pediatrics with the cooperation of the United States Public Health Service and the United States Children's Bureau. The Commonwealth Fund, New York, 1949.
(*4*) Supplement to Child Health Services and Pediatric Education: Methodology and tabulations on services. Report of the Committee for the Study of Child Health Services. The American Academy of Pediatrics with the cooperation of the United States Public Health Service and the United States Children's Bureau. The Commonwealth Fund, New York, 1949.
(*5*) Morse, W. W., and Limburg, C. C.: Availability and Use of Psychiatric Clinics: 1947. National Institute of Mental Health Series MH-B50, No. 2. Washington, U. S. Government Printing Office, 1950.
(*6*) U. S. Bureau of the Census: Population of cities of 25,000 or more, Apr. 1, 1950. Series PC-3, No. 6. Washington, December, 1950.
(*7*) U. S. Congress, House Committee on Interstate and Foreign Commerce: National Neuropsychiatric Institute Act: Hearings before a Subcommittee on Public Health, House of Representatives, 79th Cong., 1st. sess., on H. R. 2550, Sept. 18, 19, and 21, 1945. Washington, U. S. Government Printing Office, 1945.
(*8*) Standards for psychiatric hospitals and out-patient clinics approved by the American Psychiatric Association (1945–46). Am. J. Psych. **102:** 264–269 (1945).
(*9*) Conclusions concerning psychiatric training and clinics: Meeting of consultants in mental hygiene, United States Public Health Service, September 6, 1945. Pub. Health Rep. **61:** 943–957 (1946).

The Influence of Modern Treatment on Syphilis Control

By Evan W. Thomas, M.D.*

Two years ago in discussing the future of syphilis control I would have spent most of my time attempting to prove the efficacy of rapid therapy with penicillin. Today there would be little point in such an effort. The lethal effect of penicillin on the spirochetes of syphilis is now generally accepted, and it is beginning to appear that we have not one but several magic bullets against syphilis among the antibiotics. The problem today in syphilis control is no longer primarily one of case holding for treatment, but one of finding the *Treponema pallidum* before its potential victims become public charges. This problem is not yet solved, and before we congratulate ourselves on the demise of an old enemy it is well to reflect for a moment on the history of this notorious infection.

So far as we know, the organism which causes syphilis is found naturally only in man, and the origin of the infection is still controversial. We know that a disease which came to be called syphilis swept over Europe at the beginning of the sixteenth century in a peculiarly virulent form. We also know that since the sixteenth century the virulence of this infection has been slowly tamed by natural processes of increased resistance within the host. In modern times it is easy to forget the prevalence of syphilis in previous centuries and the ravages which it caused. The horrors of the disease which were supposed to be visited on the children unto the third and fourth generations have unquestionably been exaggerated because it is probable that most of us would find syphilis in our ancestry if we went back far enough. Also the story of syphilis has its light as well as dark touches. It has been suggested, for example, that in previous centuries syphilis promoted genius because so many individuals of genius were supposed to have had the infection. Such an inference has no scientific validity but it serves to impress on us the fact that syphilis was no respecter of persons and that it was extraordinarily prevalent in all classes of society. That it caused untold suffering to millions of people and imposed a heavy drain on society through the incapacitation of many individuals is well known.

Because of its prevalence, chronicity, and protean manifestations, up to the present century, syphilis was one of the major concerns of

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medicine, and it attracted the interest of the best brains in the profession. Within modern times, however, it has increasingly been relegated to the outskirts of medicine. Osler's famous epigram that to know syphilis is to know medicine is still quoted but most physicians and even some medical schools have preferred to know medicine without paying much attention to syphilis. This statement is not made in a spirit of criticism because there are readily understandable reasons for the failure of most modern physicians to maintain great interest in syphilis. The infection is now confined largely to individuals in the lowest socioeconomic groups. Few physicians, including those who specialize in dermatology, see much syphilis among their paying patients, and they have little occasion to study the disease as a whole unless they attend a syphilis clinic. Also the rapid advances in modern scientific medicine have so increased the number of subjects which must be taught in medical schools that little time can be devoted to any single disease, especially one that is now popularly believed to be on its way out because of modern therapy. Unquestionably rapid treatment of syphilis is preventing many of the late manifestations of the disease so commonly found after irregular prolonged metal therapy, but it provides no assurance that the infection is on its way out. Syphilis is still a complex disease which continues to impose numerous unsolved problems. In spite of the ease with which it can now usually be treated, I venture to predict that the infection will not be eradicated until we know more about it than at present. The war with the *T. pallidum* is not over, and we still need trained personnel if possible future set-backs are to be prevented.

If, as I have stated, the medical profession as a whole is inevitably losing interest in syphilis, where are we to look for such trained personnel? The answer, in my opinion, must be supplied by the public health departments, as it has been to a great extent for the past 10 years. Wide-spread measures for syphilis control in this country do not date back much farther than 15 years. They began with Dr. Thomas Parran while he was still Commissioner of Health in New York State. Largely through his efforts and those of his followers in the venereal disease sections of public health departments, the old taboo, which had made it impossible to print the word syphilis in the public press, was destroyed. Continuing his interest in syphilis as Surgeon General of the Public Health Service, Dr. Parran inaugurated a Nation-wide educational program about syphilis which came at a particularly fortunate time because it alerted public health workers to look for sorely needed measures in the control of the infection.

By far the most important of these needs was rapid treatment. Actually such a treatment for early syphilis was waiting to be used when Dr. Parran started his campaign. In 1933, Hyman, Chargin, and Leifer at Mt. Sinai Hospital in New York City gave massive

arsenotherapy by intravenous drip to 25 patients with early syphilis. No serious reactions occurred and the results of the treatment were satisfactory. But nothing further was done about this most important innovation until 1937 when Commissioner John L. Rice of the New York City Health Department headed a committee to investigate it. The results of this committee's investigation inaugurated advances in the control of syphilis which are only now beginning to be fully appreciated. Even though the safety of massive arsenotherapy left much to be desired, it is to the credit of the Public Health Service that the potentialities of the treatment for syphilis control were immediately realized and exploited.

Rapid treatment centers were established at strategic points throughout the country. These centers served as nuclei for educational and case-finding programs which were necessary complements to the actual treatment of early syphilis. A great variety of control measures were tried and evaluated so that now the most effective and economical programs for the future should be known. Of even greater importance, the establishment of these centers during the days of massive arsenotherapy prepared the way for prompt exploitation of the second great innovation in the treatment of syphilis. I refer, of course, to the discovery in 1943 by Dr. John Mahoney, who was then Senior Surgeon in the Public Health Service, that penicillin was an effective antisyphilitic agent. The prompt evaluation of this discovery and its effects on syphilis control are now beginning to be appreciated the world over.

A third innovation in the management of syphilis, which originally failed to receive the attention it deserved, was the introduction of quantitative serologic tests for syphilis. Like the other two innovations, this important aid to the diagnosis and treatment of syphilis had its beginnings in New York State. When Dr. Augustus Wadsworth first introduced the Maltaner-Maltaner quantitative complement fixation test for syphilis, it fell on strangely deaf ears. Only after the advent of rapid treatment was the importance of quantitative tests generally realized. Yet even with the older methods of prolonged therapy, routine determinations of the amount of reagin in patients' serum would have provided the clinician with valuable information and increased our understanding of the effects of treatment.

The pioneer efforts of Dr. Wadsworth in trying to learn more about the production of reagin by means of quantitative tests should not be forgotten and, in my opinion, the part played by the New York State serologic laboratory in initiating improved laboratory techniques should have received more attention and also more imitation than have been accorded to it as yet. As a clinician treating syphilis, I have found the Maltaner-Maltaner complement fixation test for syphilis in both blood and spinal fluid to be the best of all available tests.

Other valuable contributions to serology by the New York State laboratory are the introduction of cardiolipin antigen and the new Lange colloidal gold curve. This laboratory also has persisted in its efforts to improve existing techniques and to find new ones. At the Rapid Treatment Center in Bellevue Hospital, where much work has been done in evaluating new methods of antisyphilitic therapy, we have received invaluable assistance from the New York State laboratories. Without this aid our work would have been greatly handicapped because we, like the New York State laboratory, want only the best.

Returning now to the over-all accomplishments in syphilis control during the past 10 years, it is a fair statement that this Nation, partly through good fortune and even more by good planning, has led the world in the inauguration and evaluation of advances in the treatment of syphilis and in techniques for its control. When we recall that this country covers an area of more than 48 States, which are populated with many different races and social groups, and has large numbers of migratory workers and a political set-up designed to prevent over-centralization and to preserve the greatest possible individual freedom, the accomplishments in syphilis control over the past 10 years are indeed impressive. Such achievement would have been impossible without the antibiotics, but we also owe much to the leadership, intelligent planning, and financial aid of the public health services. Of great importance, the antisyphilitic programs sponsored by the public health services were conducted with a minimum of friction between departments at various levels and without interference with the existing type of political organization. The active cooperation of influential groups, including organized medicine, was won. Large sums of money were spent with no hint of scandal and with a minimum of that kind of ambition which seeks personal or departmental acclaim and credit rather than the public good. In these troublesome times such a record is heartening, and it renews faith in the possibilities of cooperation for the public good in a relatively free society.

No greater mistake could be made, however, than to conclude that the job of syphilis control will now be easy because of what has already been accomplished or because we now have good rapid treatment. No common infection has been eradicated by treatment alone. In fact, only those infections susceptible to attack by sanitary measures or by immunization have been successfully controlled. In the control of syphilis, prophylaxis has never been very successful and try as we may, it is improbable that we can appreciably alter the sexual habits of large numbers of people who are most likely to acquire syphilis. As for immunization, the prospect of developing practical techniques of immunizing individuals against syphilis is at present very poor.

As long as a single case of early syphilis continues to be found we can be certain that a reservoir of infectious syphilis still exists.

Therefore, the first problem in the future control of syphilis, as in the past, will be to find individuals with infectious syphilis who would not otherwise report for treatment. This involves continued education of the public, intelligent interviewing of patients for contacts, and bringing the contacts to examination.

The second problem is that of providing expert consultation service for the diagnosis and treatment of unusual or difficult cases of syphilis. In spite of modern therapy, numerous cases of syphilis are still being mistreated or poorly treated. In late syphilis it is frequently extraordinarily difficult, if not impossible, to differentiate between active and inactive infections. Fortunately in neurosyphilis, the spinal fluid examination provides us with a reasonably accurate guide to the activity of the infection, and treatment which has proved satisfactory for active neurosyphilis in a high percentage of cases should be adequate for most other types of late syphilis. It is true, however, that late syphilis continues to provide the physician with numerous problems which require the advice of those who have had much experience in the treatment of the infection. We still need trained syphilologists and, for reasons which were previously mentioned, the Public Health Service must provide them.

The third problem in the future control of syphilis is in the field of experimental research. Our ignorance of the life history of the *T. pallidum* and of immune mechanisms in the host is still very great. In view of this fact, it would be expecting far too much to predict the imminent absolute surrender of so cunning and treacherous an organism as the *T. pallidum*. We must continue to have scientific research in syphilis and, in this country, most of such research is now possible only through the Public Health Service.

Thus, for the future control of syphilis, we must look to the public health departments for three important services: case finding, trained consultants, and scientific research. The expense of such services will be large but much less than in previous years, especially when the cost of caring for the casualties of late syphilis is considered. Obviously, economies can now be made which would have been ill-advised in previous years. Rapid-treatment centers for the hospitalization of patients with syphilis are no longer needed in most parts of the country. This will save money but it means that the management of most cases of syphilis must be returned to out-patient clinics and physicians' offices which, in turn, means a dispersal of control measures and trained personnel. Obviously, the more our work can be concentrated the more effective and less costly it will be. One well-staffed, busy, and interested clinic is certain to do better work at less expense than several small clinics. In any case all clinics

and physicians treating syphilis at public expense should be in close touch with their local health departments.

At the risk of proposing ideas which may be superfluous and in some cases impossible to implement, I would suggest that the control of syphilis in the immediate future be planned along the following lines:

1. All syphilis cases treated at public expense should be referred as far as possible to clinics or physicians that are working in close cooperation with the public health services. The number of these clinics and physicians should be kept as small as possible with due consideration for the area and population involved.

2. Techniques for the control of syphilis, apart from treatment, should be centered as much as possible around the special clinics and physicians treating the disease so that all patients can be properly interviewed, names of contacts be obtained, and the patients be given some information about the disease and necessity for follow-up.

3. Funds and personnel should be made as flexible as possible so that they can be used where they are needed most. In other words, the greatest expenditure of effort should be made where the reservoir of infectious syphilis is highest. In all probability, areas with a relatively high incidence of syphilis will change from time to time and local epidemics may arise suddenly. These danger points should be discovered and attacked as promptly and as vigorously as possible.

4. Research in experimental syphilis and in human syphilis should be supported to achieve a better understanding of the disease.

Provisional *Shigella boydii* 9

By W. H. Ewing, M. C. Hucks, and M. W. Taylor*

The purpose of this paper is to report the results of studies on the biochemical and antigenic relationships between an unusual serotype, type 1296/7, and some other enterobacteria, and to propose the addition of this serotype to the *Shigella* group as provisional *Shigella boydii* 9.

Five cultures of type 1296/7 were examined. Three of these cultures, labeled provisional Boyd IX, were received in 1945 from Dr. A. E. Francis who in turn obtained them from the Central Pathological Laboratory, Middle East Forces (British). The fourth culture was isolated by Dr. A. H. Stock from a normal Arab foodhandler in North Africa during 1943. In 1945 Stock sent this culture to one of the writers for comparison with other unclassified serotypes. The fifth culture was isolated in Finland by Gildmeister in 1944 (see *13* or *10*) and was sent to the writers by Seeliger in 1949. Boyd (*1*) mentioned the isolation of six cultures of type 1296/7 in the Middle East Theater. Three of these cultures were examined by Francis (*8*) and by the writers. Francis classified the type 1296/7 cultures as provisional Flexner VIII on the basis of relationships to *Shigella flexneri* X and Y variants and to the group form of *Shigella flexneri* 4 (103B). Seeliger (*10*) and Madsen (*9*) included cultures of type 1296/7 in their studies on shigellae. Seeliger found that the Gildmeister culture, type P in German nomenclature, was the same as type 1296/7. This observation was confirmed in this laboratory. Madsen (*9*) concluded that type 1296/7 should not be placed in the *S. flexneri* group. Three other cultures included in the present study were isolated in Belgian Congo during 1949 by Courtois and Vandepitte (*4*) and were received at the writers' request. Courtois and Vandepitte stated that these cultures were antigenically identical with type 1296/7 cultures but differed markedly in their action upon lactose. These observations were confirmed in this laboratory.

The biochemical reactions of the eight cultures mentioned above are as follows: Acid was produced without gas formation from glucose and mannitol within 24 hours' incubation at 37° C. The cultures did not utilize sucrose, dulcitol, inositol, xylose, raffinose, salicin, adonitol, cellobiose, or alphamethylglucoside in 30 days; growth did not occur on Simmons' citrate agar, and citrate was not utilized in the citrate medium of Christensen (*3*). Urea was not hydrolysed and acetyl-

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methylcarbinol was not produced. The cultures varied in their utilization of several carbohydrates including lactose. These reactions are given in table 1. The cultures were composed of gram negative, nonmotile bacteria. The biochemical reactions given above are essentially the same as those recorded by other workers except that Madsen (9) reported that sucrose was fermented after 8 days by four cultures (German P, 1296/7, 1320, 356).

Antiserums were produced with formalinized broth cultures of 1296/7, 1320, and 901 (N. Africa) and with broth cultures of 1320 and 3076/50 that were heated for 2½ hours at 100° C. Subsequent tests showed that the titers of these antiserums were 1:5,120 to 1:20,480 and that all of the cultures were agglutinated to the titers of the antiserums.

Table 1. *Biochemical reactions of type 1296/7 (provisional* S. boydii *9) and related cultures*

Culture No.	Lactose	Maltose	Rhamnose	Sorbitol	Arabinose
1296/7	—	(A)	—	A	—
73 (1320)	—	(A)	(A)	A	(A)
901 (N. Africa)	—	(A)	(A)	A	—
1468 (NEF 356)	—	(A)	(A)	(A)	(A)
1692 (German P)	—	(A)	(A)	A	—
3074/50 (Di 6)	A	A	(A)	A	(A)
3075/50 (Di 7)	A	A	(A)	A	(A)
3076/50 (Di 11)	A	A	(A)	A	(A)

A = Acid production within 24 hours incubation
(A) = More than 24 hours required for acid production.
— = No fermentation, 30 days.

Heated suspensions of type 1296/7 cultures were tested in slide agglutination tests with serums prepared with cultures of all the known *Shigella* types and with antiserums produced against several unclassified *Shigella* and *Shigella*-like cultures. Those antiserums which agglutinated the microorganisms then were diluted serially and tested with broth cultures of the five type 1296/7 cultures. Both formalinized broth cultures and broth cultures that were heated for 1 hour at 100° C. were employed in these tests. Only the results of O antigen determinations, using heated cultures, are recorded in the tables. Reciprocal agglutination tests were made in the same manner. Similar tests were also made with antiserums produced with the eight O groups of the Alkalescens-Dispar (A-D) group and with antiserums prepared against cultures of *Escherichia coli* belonging to O groups 1 to 113. Preliminary tests with these antiserums were made at a dilution of 1:100, using heated broth antigens. The extent of relationships found was determined by titration and reciprocal agglutinin absorption tests. All agglutination tests for O antigen determination were read after 16 to 18 hours' incubation in a water bath at 50° C. Tests with formalinized antigens were placed in an incubator at 37° C. for 2 hours, removed to a refrigerator

(about 5° C.) for overnight incubation, and then read. All serums employed in the study were tested for the presence of alpha aglutinin (*11*) and the cultures of type 1296/7 were tested for alpha antigens with negative results.

The results of reciprocal absorption tests, using antiserums prepared with four type 1296/7 cultures, indicate that the type 1296/7 strains all contain identical heat stable somatic antigens. Courtois and Vandepitte (*4*) stated that the three lactose positive cultures isolated in Belgian Congo have O antigens identical with those of type 1296/7 strains. The results of our reciprocal agglutinin absorption tests, using O antiserums prepared with cultures 1296/7 and 3076/50 (Di 11, Belgian Congo), confirm the findings of Courtois and Vandepitte. Further, in tests made with antiserums prepared from recognized *Shigella* types, from members of the A-D group, and from known *Escherichia* O groups, the lactose positive strains react in the same manner as 1296/7 cultures.

Agglutination tests made with both formalinized and heated broth antigens in O antiserums indicate that type 1296/7 cultures contain a heat labile antigen that inhibits O agglutination. Formalinized broth antigens reacted weakly in dilutions of 1:80 to 1:320 in O antiserums that agglutinated heated antigens of the same cultures in a dilution of 1:10,240. Further studies on the heat labile antigens of these cultures are in progress.

Relationships to the *Shigella flexneri* and *Shigella boydii* Groups

Preliminary slide agglutination tests with heated suspensions of type 1296/7 cultures showed that they were agglutinated by polyvalent antiserums for the *S. flexneri* and *S. boydii* groups. Slide agglutination tests in unabsorbed antiserums prepared with the various *S. flexneri* and *S. boydii* types indicated that type 1296/7 cultures were agglutinated by antiserums for *S. flexneri* 4a, a nonspecific group variant of *S. flexneri* 4 (Rio variety), *S. flexneri* X and Y variants, and for *S. boydii* 5 (P143). The extent of these relationships was determined by titration of heated suspensions in unabsorbed antiserums (tables 2 and 3). The relationships of Alkalescens-Dispar O group 3 and 4 cultures to type 1296/7, *S. flexneri* and *S. boydii* cultures are also given in tables 2 and 3. Reciprocal agglutinin absorption tests were made in each of the instances where cross agglutination was noted. In each instance all agglutinin was removed for the absorbing cultures, but in no instance was there any significant reduction in the titers of the absorbed antiserums for their homologous cultures. The Rio antiserum, in which 1296/7 cultures reacted in a dilution of 1:2,560, is a Y-like antiserum very high in minor group agglutinin content. The reaction of type 1296/7 strains in this anti-

serum, as compared with the reaction in *S. flexneri* X and Y antiserums, is probably a reflection of the higher content of minor group agglutinin.

The type 1296/7 cultures were tested in absorbed group factor antiserums to determine whether they contained any of the *S. flexneri* group factors of diagnostic importance. Type 1296/7 strain did not react in these group factors antiserums.

Although cultures of type 1296/7 reacted slightly in antiserum prepared with *S. boydii* 5, the converse did not occur, indicating a minor unilateral relationship. Absorption of *S. boydii* 5 antiserum with suspensions of type 1296/7 strains did not result in the removal of agglutinin for A-D 03 and A-D 04 cultures from that antiserum. The relationship between *S. boydii* 5 and A-D 03 cultures, shown in table 3, is well known (for example, see *2*).

Table 2. *The relationship of type 1296/7 (provisional* S. boydii *9) and* S. flexneri *cultures*

O antigen [1] suspensions	Unabsorbed antiserums						
	Type 1296/7	*S. flexneri*				Alkalescens-Dispar (A-D)	
		4a	4 [2] Non-specific var.	X var.	Y var.	03	04
Type 1296/7	[3] 10,240	320	2,560	640	320	2,560	320
S. flexneri 4a	160	10,240	----------	----------	----------	320	640
S. flexneri 4 [2] (nonspecific var.)	320	----------	20,480	----------	----------	320	640
S. flexneri (X var.)	160	----------	----------	20,480	1,280	80	320
S. flexneri (Y var.)	320	----------	----------	20,480	20,480	160	320
A-D 03 (*S. dispar* II)	640	320	320	80	160	20,480	640
A-D 02 (*S. tieté*)	----------	----------	2,560	----------	----------	----------	----------
A-D 04 (*S. dispar* I)	40	640	640	320	1,280	160	20,480

[1] Broth cultures heated at 100° C. for 1 hour.
[2] Nonspecific of *S. flexneri* 4, variety Rio.
[3] Figures indicate reciprocal of highest dilution that gave agglutination. O=Negative in a dilution of 1:40 and higher.

Relationships to the Alkalescens-Dispar (A-D) Group

Heated broth cultures of type 1296/7 strains and A-D group cultures were tested for cross agglutination in type 1296/7 antiserum and antiserums prepared with the eight members of the A-D group. The results of these tests are summarized in table 4. Cultures of A-D 02 (*Shigella tieté*) reacted weakly in a dilution of 1:80 in type 1296/7 antiserum while type 1296/7 cultures agglutinated in a dilution of 1:1,280 in A-D 02 antiserum. The results of reciprocal agglutinin absorption tests (table 4) showed that this unilateral relationship is of a minor nature. Similar minor antigenic relationships were noted between type 1296/7 cultures and members of A-D O groups 3 and 4. Weil and Slafkovsky (*12*) reported that heated cultures of *S. tieté* (A-D 02) reacted to about 10 percent of the homologous titer of antiserums for *Shigella rio* (a variety of *S. flexneri* 4) and type 1296/7. It should be

Table 3. *The relationship of type 1296/7 (provisional* S. boydii *9),* S. boydii *5, and Alkalescens-Dispar 02 and 04 cultures*

O antigen suspensions	Antiserums						
	Type 1296/7 (Prov. *S. boydii* 9)	*S. boydii 5*				Alkalescens-Dispar	
		Unabsorbed	Absorbed by			03	04
			Type 1296/7	A-D 03	A-D 04		
Type 1296/7	20, 480	320	0	320	320	2, 560	320
S. boydii 5	0	20, 480	10, 240	10, 240	10, 240	1, 280	40
A-D 03	640	1, 280	640	0	160	20, 480	640
A-D 04	40	320	80	80	0	160	20, 480

noted that antiserum for type 1296/7 must be absorbed with a suspension of A-D 02 when the antiserum is to be used for slide tests in diagnostic work.

Relationships to the *Escherichia coli* Group

O antigen suspensions of type 1296/7 cultures were tested in O antiserum prepared with the 113 known *E. coli* O groups. The relationships noted in these tests are summarized in tables 5 and 6.

Type 1296/7 cultures reacted in antiserums for *E. coli* O groups 4, 25, and 26, but the reciprocal reaction did not occur, i. e., the *E. coli* cultures did not react in antiserums prepared with type 1296/7 cultures. The results of reciprocal agglutinin absorption tests (table 5) showed the homologous titers of the *E. coli* and type 1296/7 antiserums were not reduced. Type 1296/7 strains also were found to be related to *E. coli* O groups 68 and 102 (table 6). The relationship to O group 68 is unilateral, but type 1296/7 and *E. coli* 0102 cultures share a major antigenic fraction. However, both 1296/7 and *E. coli* 0102 contain specific antigenic fractions that are not shared (table 6). The unilateral relationships noted above are not important insofar as the classification of type 1296/7 cultures is concerned, but the relationship to *E. coli* 0102 does aid in the classification of the lactose positive cultures of Courtois and Vandepitte (*4*).

Discussion

It is clear from the studies recorded here that type 1296/7 cultures serologically are related somewhat to a variety of enteric bacteria. However, none of the relationships is sufficiently extensive to warrant classification of these microorganisms with existing types. While the type 1296/7 cultures are related slightly to certain *S. flexneri* types, the relationships are no more extensive than those of certain A-D group cultures (table 2). Furthermore, the 1296/7 cultures do not

Table 4. *The relationship of type 1296/7 (provisional* S. boydii *9) cultures and members of the Alkalescens-Dispar group*

O antigen suspensions	O antiserums									
	1296/7 (provisional *S. boydii* 9)				A-D 02		A-D 03		A-D 04	
	Unabsorbed	Absorbed by— A-D 02	A-D 03	A-D 04	Unabsorbed	Absorbed by 1296/7	Unabsorbed	Absorbed by 1296/7	Unabsorbed	Absorbed by 1296/7
1296/7 (provisional *S. boydii* 9)	10, 240	5, 120	10, 240	10, 240	1, 280	0	640	0	320	0
A-D 02	80	0	0	0	20, 480	20, 480	0	--------	0	0
A-D 03	320	--------	0	0	2, 560	--------	20, 480	20, 480	640	0
A-D 04	640	--------	0	0	320	--------	160	0	20, 480	20, 480

Table 5. *The relationship of type 1296/7 (provisional* S. boydii *9) cultures to* E. coli *0 groups 4, 25, and 26*

O antigen suspensions	O antiserums									
	Type 1296/7				*E. coli* 04		*E. coli* 025		*E. coli* 026	
	Unabsorbed	Absorbed by *E. coli* 04	025	026	Unabsorbed	Absorbed by— 1296/7	Unabsorbed	Absorbed by— 1296/7	Unabsorbed	Absorbed by— 1296/7
Type 1296/7	10, 240	10, 240	10, 240	10, 240	2, 560	0	10, 240	0	2, 560	0
E. coli 04	0	0	0	0	10, 240	10, 240	640	--------	--------	--------
E. coli 025	0	--------	0	--------	--------	--------	20, 480	20, 480	640	--------
E. coli 026	0	--------	--------	0	--------	--------	--------	--------	10, 240	10, 240

Table 6. *The relationship of type 1296/7 (provisional* S. boydii *9) cultures and* E. col *O groups 68 and 102*

O antigen suspensions	O antiserums								
	Type 1296/7			*E. coli* 068			*E. coli* 0102		
	Unabsorbed	Absorbed by *E. coli* 068	0102	Unabsorbed	Absorbed by— 1296/7	*E. coli* 0102	Unabsorbed	Absorbed by— 1296/7	*E. coli* 068
Type 1296/7	20, 480	20, 480	20, 480	20, 480	0	1, 280	20, 480	0	640
E. coli 068	40	0	0	20, 480	1, 280	1, 280	320	0	0
E. coli 0102	20, 480	2, 560	0	10, 240	80	0	20, 480	20, 480	10, 240

contain any of the more important *S. flexneri* group factors that are used in diagnostic work for the separation of subtypes of *S. flexneri*. Similarly, type 1296/7 cultures are not related in a significant way to members of the A-D group. The relationships noted (table 4) are unilateral and are not sufficiently extensive to warrant inclusion in that group. The same may be said for the relationships noted between

type 1296/7 strains and certain *E. coli* O groups (tables 5 and 6), except for the strong antigenic relationship between type 1296/7 and *E. coli* 0102 cultures (table 6). These lactose positive cultures may be regarded as anaerogenic members of *E. coli* O group 102, or they may be regarded for the present simply as aberrant coliform cultures without reference to their taxonomic position. The fact that the type 1296/7 cultures are related to *E. coli* O group 102 does not mean that they should be classified as *E. coli* O group 102. The biochemical reactions of type 1296/7 cultures are like those of typical shigellae as defined by Ewing (*6*) and by the Shigella Commission of the International Congress of Microbiologists. It is known that the O antigens of many *Shigella* types are related to, and in some cases identical with, those of certain *E. coli* O groups. Thus, serological relationship to the *E. coli* group cannot, by itself, be used as a means for the exclusion of *Shigella*-like microorganisms from the *Shigella* group.

Such relationships serve to emphasize the fact that the family Enterobacteriaceae is a large interrelated group of bacteria and, further, that a study of the biochemical reactions of unknown cultures must never be omitted as a part of diagnostic work with enteric bacteria. For a review of known *Shigella-Escherichia* relationships, see Ewing, Hucks, and Taylor (*7*).

Since the biochemical reactions of type 1296/7 cultures are similar to those given by members of the *Shigella* group, and since the cultures ferment mannitol but are not related in any significant way to members of the *S. flexneri* group, it is proposed that type 1296/7 be added to *S. boydii* group as provisional *Shigella boydii* 9. Group C of the *Shigella* schema, the *S. boydii* group, now is composed of seven types (*6*). The Shigella Commission accepted type 112 of Cox and Wallace (*5*) as provisional *Shigella boydii* 8. These provisional *S. boydii* types will be added to the *Shigella* schema after confirmation and acceptance by other investigators.

Summary

Studies are reported on the biochemical and serological relationships of type 1296/7 cultures. It is proposed that this type should be called provisional *Shigella boydii* 9.

REFERENCES

(*1*) Boyd, J. S. K.: Laboratory findings in clinical dysentery in Middle East Force between August 1940 and June 1943. J. Path. and Bact. **58:** 237–241 (1946).

(*2*) Carpenter, P. L., and Stuart, C. A.: Antigenic relationship of *Shigella dispar*, types I and II, to *Shigella paradysenteriae*, Boyd type P143. Proc. Soc. Exper. Biol. and Med. **61:** 238–240 (1946).

(*3*) Christensen, W. B.: Hydrogen sulfide production and citrate utilization in the differentiation of the enteric pathogens and the coliform bacteria. Research Bull. (Weld County, Colo., Health Dept.) **1:** 3–16 (1949).

(*4*) Courtois, Gh., and Vandepitte, J. M.: Personal communications (1950).

(5) Cox, C. D., and Wallace, G. I.: A study of *Shigella* isolated in India and Burma, with special reference to two previously undescribed serotypes. J. Immunol. **60**: 465–473 (1948).
(6) Ewing, W. H.: *Shigella* nomenclature. J. Bact. **57**: 633–638 (1949).
(7) Ewing, W. H., Hucks, M. C., and Taylor, M. W.: Interrelationship of certain *Shigella* and *Escherichia* cultures. J. Bact. In press.
(8) Francis, A. E.: Two new types of *Shigella flexneri*. J. Path. and Bact. **58**: 320–322 (1946).
(9) Madsen, S.: On the Classification of the *Shigella* Types. Ejnar Munksgaard, Copenhagen, 1949.
(10) Seeliger, H.: Über die Ergebnisse vergleichender Untersuchengen der deutschen Ruhrtypen G, M, P, mit amerikanischen und britischen Shigellastämen. Zeit. f. Hyg. **129**: 444–458 (1949).
(11) Stamp, L., and Stone, D. M.: An agglutinogen common to certain strains of lactose and non-lactose-fermenting coliform bacilli. J. Hyg. **43**: 266–272 (1944).
(12) Weil, A. J., and Slafkovsky, H.: *Shigella tieté*. J. Bact. **55**: 759–762 (1948).
(13) Winkle, S.: Zur Diagnostik und Epidemiologie der Paradysenterie. Gustav Fischer, Jena, 1949.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

Announcement

The new monthly PUBLIC HEALTH REPORTS (see back cover) will publish from time to time, as appropriate, reports, tabulations, and articles dealing with morbidity statistics, both domestic and foreign. The present weekly "Incidence of Disease" section, however, will be discontinued as of December 31, 1951.

Current provisional morbidity data on notifiable diseases for the United States will continue to appear in summary form and in tabulations by States and cities in the *Weekly Morbidity Report* issued by the National Office of Vital Statistics of the Public Health Service.

Libraries and agencies that have depended upon PUBLIC HEALTH REPORTS for current morbidity statistics for the United States may continue to receive the same data by writing to the National Office of Vital Statistics, Washington 25, D. C., requesting that they be placed on the mailing list for the *Weekly Morbidity Report.* Individuals who wish to be placed on the mailing list should indicate how and to what extent they will make use of this publication.

Since the *Weekly Epidemiological Record* and other publications of the World Health Organization, Geneva, Switzerland, contain morbidity data for foreign countries, tabulations of notifiable diseases occurring outside the United States and its Territories will not appear regularly in National Office of Vital Statistics publications.

UNITED STATES

Reports From States for Week Ended November 10, 1951

Although the incidence of diphtheria was less for the current week than the previous week in the country as a whole, there was a small increase reported in the southern States (South Atlantic, East South Central, and West South Central States). In these groups the States that reported 10 or more cases were Virginia (13), North Carolina (10), Georgia (13), Alabama (13), and Texas (13). Since July 1, the seasonal low point of incidence, North Carolina has reported 202 cases, Texas 165, Alabama 145, South Carolina 97, Georgia 91, Virginia 80, and Tennessee 76 cases.

Only 19 cases of malaria in civilians were reported for the current week. One reported by California was a *Plasmodium falciparum* type of infection in a Mexican national. The patient has been returned to Mexico by the Agricultural Labor Bureau and the Mexican consul.

The number of cases of poliomyelitis for the current week was

approximately 20 percent less than that for the previous week. Only 3 States reported more than 30 cases—California (106), Texas (49), and Michigan (36).

There was a 10 percent increase in the number of measles cases reported. Nearly one-third of the total cases were reported in the Middle Atlantic States.

Fewer cases of meningococcal meningitis were reported for the current week than for either of the previous 2 weeks.

One case of smallpox was reported from Ohio. The case reported last week was in an individual who had never been vaccinated.

The above data exclude Florida from which no report was received for the current week.

Epidemiological Reports

Human Rabies

The case of human rabies previously reported in Iowa was a 6-year-old boy. It was the first case since 1944 in the State. The diagnosis was made post mortem. No history of contact with a rabid animal could be obtained except that 1 year previously the boy had visited a home where a dog was chained because it was under observation for rabies. This animal was proved to have the disease, and special care was taken to see that no one had any exposure.

Anthrax

Dr. L. L. Parks, Florida Board of Health, has supplied additional information on anthrax in Florida. One case of anthrax was reported the third week in October in Broward County, Fla. It occurred in a cowboy who had skinned a cow that had died and subsequently was found to have anthrax. Approximately 150 cows have died in this area within the last 6 weeks. Two veterinarians have since developed skin anthrax. They had been vaccinating the cows in this area. One laboratory technician has since developed skin anthrax, and she had been working in the laboratory handling anthrax organisms in this area. A child of the nurse who waited on the veterinarians that had anthrax has been reported to have developed skin anthrax. This makes a total of five cases that have been reported in Florida within the last 6 weeks. The cattle have been immunized, and apparently the disease among the cattle is now under control, but undoubtedly additional cases will occur among the cattle as this area has not been reported to have had anthrax for many years prior to this outbreak.

Gastroenteritis

Dr. M. B. Goodman, New York State Health Department, has reported an outbreak of gastroenteritis involving an unknown number of 1,800 visitors and 9 of approximately 76 persons living in an institution. The source of the outbreak was considered to be ham from which

Staphylococcus aureus was isolated. The ham was kept at room temperature for a considerable period of time after it was baked.

Dr. Goodman also reported a family outbreak in which roast chicken was considered to be the vehicle of infection. When eaten on the day following preparation, gastroenteritis developed in all members who ate it. No food was available for laboratory examination. The roast chicken was left on the stove overnight without refrigeration.

Dr. H. T. Fuerst, New York City Department of Health, has reported an outbreak of bacillary dysentery in 12 inmates of a State mental institution located in Brooklyn, New York. The outbreak has been limited to a single floor in one wing of one of the hospital buildings. The total number of persons at risk in this limited area is 66. The 12 cases had their onsets rather uniformly staggered, from October 29 to November 7, 1951. The usual symptoms were fever, vomiting, and diarrhea of some 3 to 4 days duration. Melena occurred in two cases. One death, attributed to diabetes and hypoglycemia, occurred after cessation of acute gastrointestinal symptoms. An organism resembling *Shigella* has been cultured from stools of some patients in the hospital laboratory, and awaits further identification. There is no evidence that a food or other common source was responsible for this outbreak. Transmission of infection is presumed to have occurred through personal contact. There have been no cases among hospital employees in the involved area or elsewhere.

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Nov. 10, 1951	Nov. 11, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	------	------	1	(1)	(1)	(1)	(1)	50	40	45
Diphtheria (055)	120	126	241	27th	[2] 1,470	2,003	3,610	[2] 3,478	5,131	8,221
Encephalitis, acute infectious (082)	12	16	12	(1)	(1)	(1)	(1)	915	857	576
Influenza (480–483)	444	678	792	30th	4,889	7,590	7,590	120,944	146,354	134,668
Measles (085)	2,262	1,661	1,544	35th	13,646	8,811	8,562	482,557	296,982	565,154
Meningitis, meningococcal (057.0)	59	74	58	37th	493	482	451	3,554	3,281	3,021
Pneumonia (490–493)	801	1,037	(3)	(1)	(1)	(1)	(1)	52,554	70,958	(3)
Poliomyelitis, acute (080)	619	890	669	11th	24,972	28,667	24,690	26,184	29,798	25,040
Rocky Mountain spotted fever (104)	3	1	2	(1)	(1)	(1)	(1)	323	446	541
Scarlet fever (050) [4]	895	996	1,165	32d	6,614	7,203	9,285	60,000	47,373	65,292
Smallpox (084)	1	------	1	35th	3	3	4	14	29	51
Tularemia (059)	8	6	8	(1)	(1)	(1)	(1)	567	784	831
Typhoid and paratyphoid fever (040, 041) [5]	59	50	61	11th	2,335	2,591	2,999	2,770	3,100	3,484
Whooping cough (056)	1,129	1,780	1,780	39th	[6] 6,135	9,374	9,374	[6] 59,910	106,569	85,663

[1] Not computed. [2] Addition: North Carolina, week ended Oct. 13, one case. [3] Data not available. [4] Including cases reported as streptococcal sore throat. [5] Including cases reported as salmonellosis. [6] Additions: Rhode Island, weeks ended Oct. 27 and Nov. 3, four and three cases, respectively.

NOTE.—Data exclude figures from Florida for week ended Nov. 10, 1951, from which no report was received.

Plague Infection in Douglas and Lincoln Counties, Washington

R. P. Lonergan, Western CDC Laboratory, reports that the following specimens have been proved positive for plague: A specimen consisting of 126 fleas, *Megabothris clantoni, Meringis shannoni, Thrassis gladiolis johnsoni*, from 148 sagebrush voles, *Lagurus curtatus*, trapped October 10, 1951, 9 miles north of Farmer on County Road in Douglas County. A specimen consisting of 394 fleas, *Megabothris clantoni, Thrassis gladiolis johnsoni, Meringis shannoni, Catallagis charlottensis, Meringis walderi*, from 180 sagebrush voles, *Lagurus curtatus*, trapped October 19, 1951, 5 miles northeast of Leahy in Douglas County. A specimen consisting of 429 fleas, *Megabothris clantoni, Thrassis gladiolis johnsoni, Monopsyllus wagneri, Meringis shannoni, Catallagia charlottensis, Micropsyllus sectilis*, from 114 sagebrush voles, *Lagurus curtatus*, trapped October 20, 1951, 4 miles southwest of Davenport in Lincoln County.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Nov. 10, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**120**	**12**	**444**	**2262**	**59**	**801**	**619**
New England				**262**	**5**	**27**	**13**
Maine				17		5	1
New Hampshire				6			
Vermont				1			
Massachusetts				97	2		4
Rhode Island				59	2	1	1
Connecticut				82	1	21	7
Middle Atlantic	**4**	**1**	**3**	**814**	**12**	**75**	**52**
New York	3		(1)	342	7		27
New Jersey			3	130		45	4
Pennsylvania	1	1		342	5	30	21
East North Central	**13**	**4**	**32**	**407**	**10**	**60**	**114**
Ohio	1			69	5		12
Indiana	8	1	26	24		5	10
Illinois		2	1	121	2	39	27
Michigan	3	1	5	147	1	16	36
Wisconsin	1			46	2		29
West North Central	**9**	**1**	**1**	**50**	**3**	**138**	**71**
Minnesota	3	1		22		24	13
Iowa	1			1	1		10
Missouri	5			6	1		20
North Dakota				5		105	1
South Dakota				2			1
Nebraska				5	1		8
Kansas			1	9		9	18
South Atlantic	**46**	**1**	**32**	**254**	**7**	**93**	**24**
Delaware							1
Maryland	2	1	3	117	1	20	
District of Columbia				8		19	1
Virginia	13			64	2	27	4
West Virginia	2			41	1		7
North Carolina	10			8	2		4
South Carolina	6		3	3		3	
Georgia	13		26	13	1	24	7
Florida [2]							
East South Central	**28**	**1**	**6**	**55**	**3**	**32**	**57**
Kentucky	5		2	29	1	2	15
Tennessee	9			5	1		13
Alabama	13			10		11	11
Mississippi	1	1	4	11	1	19	18
West South Central	**16**	**3**	**102**	**61**	**9**	**241**	**84**
Arkansas			68	1	3	29	6
Louisiana			1	1	1	13	22
Oklahoma	3		33	1		10	7
Texas	13	3		58	5	189	49
Mountain	**3**		**206**	**116**	**2**	**73**	**60**
Montana				24			1
Idaho				3			7
Wyoming				6		2	12
Colorado	1		8	23	1	17	11
New Mexico	1		2	6		25	8
Arizona	1		196	8		29	8
Utah				45	1		13
Nevada				1			
Pacific	**1**	**1**	**62**	**243**	**8**	**62**	**144**
Washington			40	56	2	2	21
Oregon			6	42		21	17
California	1	1	16	145	6	39	106
Alaska							
Hawaii			135	611		2	1

[1] New York City only.

[2] Report not received.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Nov. 10, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	3	895	1	8	59	1,129	132
New England		38			5	110	
Maine		3				2	
New Hampshire		2				9	
Vermont						19	
Massachusetts		29			4	64	
Rhode Island		1				3	
Connecticut		3			1	13	
Middle Atlantic		160		1	6	234	37
New York		72			2	77	20
New Jersey		10				80	
Pennsylvania		78		1	4	77	17
East North Central		209	1	1	3	190	25
Ohio		48	1			27	7
Indiana		37			1	23	4
Illinois		31		1		23	7
Michigan		67			2	64	6
Wisconsin		26				53	1
West North Central		61			8	39	13
Minnesota		7					12
Iowa		12			2	7	
Missouri		22			6	17	1
North Dakota		1				1	
South Dakota							
Nebraska							
Kansas		19				14	
South Atlantic	1	126		3	7	74	25
Delaware		3					
Maryland	1	15			3	13	
District of Columbia		14				1	
Virginia		26			1	10	2
West Virginia		10				11	3
North Carolina		41				18	4
South Carolina		4				2	4
Georgia		13		3	3	19	12
Florida [3]							
East South Central		82			5	78	9
Kentucky		26			2	33	1
Tennessee		37			2	19	2
Alabama		16				23	4
Mississippi		3			1	3	2
West South Central	1	22		3	7	265	23
Arkansas		3			1	14	4
Louisiana		1		1	2		
Oklahoma	1	1			2	16	2
Texas		17		2	2	235	17
Mountain	1	27			5	68	
Montana		7			1	5	
Idaho		3				3	
Wyoming		2					
Colorado		4				10	
New Mexico		2				27	
Arizona					4	19	
Utah	1	8				4	
Nevada		1					
Pacific		170			13	71	
Washington		20				2	
Oregon		27				3	
California		123			13	66	
Alaska							
Hawaii		1					

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.
[3] Report not received.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended October 27, 1951

Disease	Total	New-found-land	Prince Edward Island	Nova Scotia	New Bruns-wick	Que-bec	On-tario	Mani-toba	Sas-katch-ewan	Al-berta	Brit-ish Co-lum-bia
Brucellosis	1						1				
Chickenpox	640	12		8	5	42	308	36	27	103	99
Diphtheria	10					10					
Dysentery:											
Amebic	5					4			1		
Bacillary	4							1			3
Encephalitis, infectious	1								1		
German measles	89	1		2		13	23	2	4	18	26
Influenza	35			22			3				10
Measles	416	15		24	2	80	31	5	17	110	132
Meningitis, meningococcal	5	1		1			2				1
Mumps	284	11		2	3	45	146	29	10	19	19
Poliomyelitis	47			7	4	2	26	2	4		2
Scarlet fever	283	3		1	2	27	31	21	19	39	140
Tuberculosis (all forms)	158	16			4	65	23	13	8		29
Typhoid and paratyphoid fever	15	1				12			2		
Venereal diseases:											
Gonorrhea	238	6		4	6	52	50	26	24		70
Syphilis	65	3		4	2	26	11	2	2		15
Primary	6	1		1		1	2				1
Secondary	3					2					1
Other	56	2		3	2	23	9	2	2		13
Other forms	1										1
Whooping cough	182					39	61	25	19	34	4

JAMAICA

Reported Cases of Certain Diseases—4 Weeks Ended Sept. 22, 1951

Disease	Total	Kingston	Other localities
Chickenpox	11	5	6
Diphtheria	8	3	5
Leprosy	2		2
Puerperal sepsis	1		1
Scarlet fever	1		1
Tuberculosis, pulmonary	65	28	37
Typhoid fever	47	4	43

NOTE.—No report for week ended Sept. 29 was received from Jamaica.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Cholera

Burma. During the week ended October 27, one case of cholera was reported in Tavoy as compared with seven for the previous week.

India. For the week ended November 3, cholera was reported in seaports of India as follows: Calcutta, 57 cases and Madras, 28. During the previous week Calcutta reported 63 cases and Madras reported 25.

India (French). During the period October 11–20, 21 cases of cholera were reported as compared with 31 for the previous 10-day period.

Pakistan. During the week ended November 3, 16 cases of cholera were reported in Dacca and for the week ended October 27, 5 cases were reported in the seaport of Chalna.

Plague

Brazil. During October, three cases (one death) of plague were reported in Jiquie County, Bahia State.

Ecuador. During October, one case of plague was reported in Durazno, Loja Province.

Indochina. One case of plague was reported in Phanthiet, Viet Nam, for the week ended November 3.

Smallpox

Burma. An outbreak of smallpox has occurred in Mergui; 18 cases were reported for the week ended November 3 as compared with 8 for the previous week. There were no cases reported between August 18 and October 21. For the week ended November 3, Rangoon and Moulmein reported two and one cases, respectively.

Indochina. During the week ended October 27, 20 cases of smallpox were reported in Cambodia.

Togo (French). For the period October 11–20, 25 cases of smallpox were reported as compared with 9 for the previous 10-day period.

Typhus Fever

Chile. For the week ended October 27, three cases of typhus fever were reported in Santiago.

Eritrea. During the week ended October 27, three cases of typhus fever were reported as compared with one for the previous week.

India. During the week ended October 27, one case of typhus fever was reported in the seaport of Bombay.

Yellow Fever

Costa Rica. During the period October 18–29, jungle yellow fever was reported as follows: San Carlos Zone, Alajuela Province, two cases; Potrero Grande Zone, Puntarenas Province, two cases.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work.

Requests for and communications regarding the PUBLIC HEALTH REPORTS and reprints should be addressed to the Surgeon General, Public Health Service, Washington 25, D. C. Subscribers should remit direct to the Superintendent of Documents, Washington 25, D. C.

Librarians and others should preserve their copies for binding, as the Public Health Service is unable to supply the general demand for bound copies. Indexes will be supplied upon request.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
Price 15 cents. Subscription price $4.75 a year. $6.25 foreign.

—Announcement—

PUBLIC HEALTH REPORTS

To be Published Monthly Next Year

Beginning in January 1952 PUBLIC HEALTH REPORTS will be published monthly. Two other technical publications of the Public Health Service—the Journal of Venereal Disease Information and the CDC Bulletin—are being merged with it.

The merger has come about as the result of an extended study of the Public Health Service's publishing activities. The new journal is designed to carry out more efficiently and economically the Public Health Service's responsibilities for disseminating scientific information on matters of health.

The new PUBLIC HEALTH REPORTS will be concerned with the technical and professional aspects of public health practice, with problems of health administration, and with research in these fields. It will include substantially the types of material that have been appearing in the three present journals and the monthly Tuberculosis Control Issue of PUBLIC HEALTH REPORTS. There will be more emphasis, however, on administrative practice, program development, and applied research aspects and less emphasis on bench research and clinical material not rather directly related to public health practice.

As has been true with each of the present journals, the pages of the new PUBLIC HEALTH REPORTS will be open, on merit, to any responsible author. General editorial guidance will be provided by a Board of Editors composed of individuals of recognized competence and professional stature drawn from both within and outside the Federal service.

Every effort will be made to furnish the new PUBLIC HEALTH REPORTS to representative organizations in public health and its related fields. Most of the readers on the mailing list are affiliated with organizations to which free distribution can legally be made. They will continue to receive the new journal either directly or through these organizations.

The first issue of the new PUBLIC HEALTH REPORTS and an application form for a free subscription will be sent to readers now on the free lists for technical periodicals. After they have had an opportunity to review the new PUBLIC HEALTH REPORTS and to consider its usefulness in their work, readers who wish to remain on the lists and receive the new periodical regularly should complete the application and send it in as soon as possible. This will allow time to revise the lists for mailing the second and subsequent issues.

The new PUBLIC HEALTH REPORTS will also be available by paid subscription from the Superintendent of Documents, Government Printing Office.

Public Health Reports

VOLUME 66 — DECEMBER 7, 1951 — NUMBER 49

[To be published monthly in 1952—see back cover]

TUBERCULOSIS CONTROL ISSUE NO. 70

IN THIS ISSUE

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V. The Medical Profession
VI. Records and Reports

The Finnish Trambusti Tuberculin Test

FEDERAL SECURITY AGENCY

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Oscar R. Ewing, Administrator

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This is the seventieth of a series of special issues of PUBLIC HEALTH REPORTS devoted exclusively to tuberculosis control. The special issues began March 1, 1946, and appear the first week of each month. The articles are reprinted as extracts. Effective with the July 5, 1946, issue, these extracts may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 10 cents a single copy. $1.00 a year, domestic; $1.25, foreign.

Public Health Reports

Vol. 66 • DECEMBER 7, 1951 • *No. 49*

—Announcement—

This is the last Tuberculosis Control Issue of PUBLIC HEALTH REPORTS to be published in this format. As announced on the back cover, PUBLIC HEALTH REPORTS will be published monthly beginning in January of 1952. The new journal will include part of the same type of material on tuberculosis control which has been appearing in these special issues; the more technical research papers will be issued in other publications.

We have appreciated the interest in the Tuberculosis Control Issue, which has been shown both by criticism and commendation of the articles published. We hope that this interest will continue to contribute to PUBLIC HEALTH REPORTS in its new format and under its new editorship. The new avenues of publication will be strengthened by the kind of comment which has been helpful to us in the past and by the participation of authors who are active in the many disciplines of tuberculosis control.

R. J. ANDERSON, *Medical Director,*
Chief, Division of Chronic Disease and Tuberculosis.

Community-Wide Chest X-ray Survey

V. The Medical Profession

By Paul A. Pamplona, M.D., M.P.H.*

The active participation and leadership of the medical profession are essential in all the steps of a community-wide chest X-ray survey. They are essential in the earliest discussions of whether such a program is to be undertaken, throughout all planning for a survey, and during the period when X-raying is being done. They are essential during the months and years of follow-up. Prevention, diagnosis and treatment of disease and rehabilitation of the patient are the objectives of all medicine—the first aim of the practitioners of this science. Prevention, diagnosis, and treatment of tuberculosis and restoration of the tuberculous patient are the ultimate objectives of a community-wide chest X-ray survey.

Any program designed to find unknown cases of disease has value only if it sets in motion a series of procedures by which the suspected cases of disease thus uncovered are diagnosed and treated. With a communicable disease such as tuberculosis, additional public health value is derived from a screening program, since it brings under medical supervision cases which might otherwise go undiscovered and untreated until the patients' chances of full recovery were lessened and the possibilities of spreading the disease extended. Community-wide case finding for tuberculosis, therefore, offers the physician the opportunity of serving to his fullest measure. He is called upon to diagnose and treat previously unidentified cases. He plays a vital role in preventing the continuing spread of the disease.

During the past 5 years, 17 metropolitan areas have conducted community-wide chest X-ray surveys. In each instance, the three major local groups interested in case finding for tuberculosis—the official health agency, the medical society, and the tuberculosis association—have agreed that a survey would be desirable and have determined the geographic area to be included. Finding their local facilities insufficient for such large and concentrated projects, they have requested help, through their State health departments, from the Public Health Service. The contribution of the Service is in the form of equipment and trained professional and nonprofessional personnel to supplement local facilities (*1*).

The official health agency alone, or even with the assistance of

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the medical society and the tuberculosis association and the Public Health Service, could not carry out the project successfully without active participation of many groups and individuals in the community whose ordinary pursuits are not connected with health. Because a chest X-ray survey is a medical and public health program, however, it is usually originated by the medical profession.

The early considerations which must be covered before the program can begin are in the province of medicine, both clinical and public health. The pattern of tuberculosis in the area—in terms of annual deaths, known cases, cases diagnosed in the advanced stages and cases first reported through death certificates—concerns both the health officer and the clinician. It is this pattern which determines the need for community action. The need is usually readily recognized, but the means for effective action often are not so apparent and must be sought.

Long before a survey begins, a careful review of the resources and facilities is needed to insure a successful case-finding program as well as adequate follow-up. Laboratory service, clinics, hospitals—whether local or State, private or public—as well as medical, nursing, medical social services and other resources in the community are inventoried. This gives the community an opportunity to correct any situations which may hinder the program, by filling in where inadequacies are found, before operations start.

In many communities where there are adequate provisions for the diagnosis and care of known tuberculosis cases, the fear is expressed that existing facilities cannot absorb a case load resulting from a survey. Almost without exception in these areas there are adjustments that can be made which can extend the existing provisions to take care of larger case loads. A recurrent situation in the surveys in which the Public Health Service has had a part has been the lack of sufficient hospital beds for all tuberculosis patients. Whether or not there were hospital beds for all cases found, however, a large number of persons with previously unidentified tuberculosis have been brought under medical supervision at a stage of disease when medical care could be most effective.

Early discussions, evaluations, and decisions which precede the actual undertaking of a survey are carried on informally by doctors who represent the local practicing physicians, local official health agencies, and the Public Health Service. Their association and cooperation continue after the survey has been decided upon and throughout its planning and operation, and many of the medical functions of the survey call for their combined effort. For the purposes of this presentation, however, it seems simpler to discuss medical participation in the survey in three sections, according to the affiliation of the physicians concerned.

Local Practicing Physicians

The organization which is set up to operate the survey has always included, as one of its three major sections (*1*), a group representing the professions directly concerned with tuberculosis control: physicians, nurses, and medical social workers. Nursing and medical social work in community-wide chest X-ray surveys have been discussed in previous papers (*2*, *3*) and will be mentioned here only as they relate to the work of the medical profession.

The medical society is one of the sponsors of a community-wide survey. The president of the society, or the chairman of its public health or tuberculosis committee, as the case may be, is often the physician who takes part in preliminary work with other sponsors in forming an organization. He or another physician representing the medical association usually serves as temporary chairman of the medical committee and calls upon other doctors to participate as members of the committee. When this group has been brought together, permanent chairmen for the committee and subcommittees are elected.

Members of the survey medical committee include general practitioners, as well as specialists in the various fields directly concerned: radiologists, internists, specialists in diseases of the chest, chest surgery, heart disease, and cancer. Before definite plans take shape, the initial planners of the survey must decide what types of screening will be undertaken, and what follow-up will be done for suspected cardiovascular abnormality and other diseases of the chest, as well as for tuberculosis. Upon these decisions will depend, to a certain extent, the composition of the medical committee. The health department places first emphasis on the follow-up of tuberculosis because of its communicability. The extent of follow-up work which can be provided for diseases other than tuberculosis will depend upon the policies and facilities of this agency.

The health officer and the physician in charge of tuberculosis control, as well as the Public Health Service medical officer, have a definite contribution to make as members of the medical committee, so that decisions can be made with full consideration of how they will affect and be affected by the established programs. When, for instance, the committee discusses follow-up services for persons whose X-rays show suggested cardiovascular disease, the health officer and his staff can plan with the committee for the extent and kind of public health nursing service that can be used, the clinic facilities that can be made available, and other pertinent information. The Public Health Service medical officer can be of valuable assistance to the committee since he can describe the variety of methods used in other cities in similar situations. For example, in one survey, cardiovascular suspects were telephoned by a public health nurse and

advised to check with their physicians; in another, they were recalled for a second 70-mm. chest film and a short epidemiological history was taken by a public health nurse, before referral for medical care; and in still another, they were recalled for the history only and then referred to their physicians. The reasons which prompted the adoption of the different policies and the implications of each in terms of cases detected and work involved are discussed with the committee.

While the medical committee operates as a single group in matters of over-all policy, its province in the survey is so large that division of activities among a number of smaller groups is required. There is usually a group concerned with management and disposition of suspects, another with film interpretation and consultation, and a third with medical information.

Management and Disposition of Suspects

The considerations of this committee have to do with (1) criteria for 70-mm. and 14″ x 17″ chest film interpretation; (2) procedures to be followed when suspects are recalled; (3) recommendations for the management of survey suspects referred to physicians.

The 70-mm. chest X-ray films taken in a survey are read by Public Health Service medical officers and classified as essentially negative, tuberculosis suspect, nontuberculous chest disease suspect, cardiovascular disease suspect, or technically unsatisfactory film. The criteria for the interpretation of 70-mm. chest fluorograms and 14″ x 17″ confirmatory films are standards based on accepted medical principles. The physicians on the committee on management have found it helpful to use classifications and standards as stated in other surveys with only minor variations adapted to local situations. The 70-mm. chest films are interpreted in accordance with these recommendations.

The following list is quoted directly from the medical brochure of the Contra Costa County (California) chest X-ray survey:

I. Persons with the following thoracic and pulmonary abnormalities should be recalled:

A., B. Tuberculosis and nontuberculous chest diseases suspects:

1. All areas of increased pulmonary density in the lung parenchyma regardless of shape, size or location, with the exception of small calcified nodules such as are associated with primary infection tuberculosis.
2. Cystic lung lesions including single and multiple tension cysts, extensive bullous emphysema, or localized obstructive emphysema.
3. Abnormally prominent interstitial lung markings.
4. Plural fluid or pneumothorax.
5. Any significant elevation of the diaphragm or suggested evidence of hernia.
6. Single or multiple destructive lesions of the thoracic bones, unhealed fractured ribs, clavicle, etc.

7. All suspected mediastinal tumors including uncalcified hilar lymphadenopathy.
8. Kyphosis of a degree that raises the suspicion of destructive lesions of the vertebrae, or cardiac embarrassment.

C. Cardiovascular diseases suspects:

1. Recall of cardiovascular diseases suspects should be conservative and at the discretion of the film reader.

D. Unsatisfactory films:

1. Mechanical or technical failure; unsatisfactory screening film.
2. Artifact. Shadows due to extraneous objects that either obscure the chest or cannot be readily differentiated from a definite chest abnormality. Persons with unsatisfactory films of one kind or another are referred for another 70-mm. or 14″ x 17″ if necessary.

II. Persons with the following findings, although not necessarily normal, need not be recalled.

A., B. Tuberculosis and nontuberculous chest diseases suspects:

1. Calcified nodules as are commonly seen in healed primary infection tuberculosis, discrete scattered calcification as found in healed histoplasmosis or other fungus infections.
2 Prominent interstitial lung markings as are consistent with the person's size and age.
3. Evidence of definitely healed pleural changes such as apical caps, blunting of the costophrenic angle (except in young individuals), and evidence of old empyema where no recent active process is suspected.
4. Minor irregularities and so-called diaphragmatic adhesions.
5. Congenital abnormalities of the bony thorax such as bifid ribs, cervical ribs, etc., healed fractured ribs or clavicle.
6. Calcified hilar or tracheobronchial nodes; calcified lobe of thyroid or areas of discrete calcification in the neck.
7. Kyphosis and scoliosis, provided there is no suspicion of bony destruction or cardiac embarrassment.
8. Metallic foreign bodies, uncomplicated.

With one exception [1] medical committees have always recommended that persons whose 70-mm. X-ray readings fall in the A and B group (tuberculosis and nontuberculous chest diseases suspects) be recalled to a retake center for a 14″ x 17″ film and an interview with a public health nurse. The nurse takes a short epidemiological history and obtains information, including the name of the family physician, for use in subsequent follow-up if that becomes necessary. At this time the nurse explains that the reading of the X-ray screening film does not constitute a diagnosis, and prepares the person she is interviewing for any later steps he may need to take, stressing the importance of following through with recommendations. If the person does not have a private physician but wants private medical care, the nurse advises

[1] In Denver, the medical committee and all concerned agreed that it would be better to have all suspected cases routed through a central clinic first, and then referred to the private physician.

him to call the local medical association for help in selecting a physician. He is given a postcard to be returned to survey headquarters giving his physician's name when he has decided on one, so that the report of the X-ray interpretation can be sent to the doctor.

There are always cases in every survey which need special attention, and the committees have established policies to meet these emergencies. For example, in one survey the shadows observed on one of the 70-mm. screening films suggested the possibility of the presence of bronchogenic carcinoma. The physician who read the film notified the records department so that an immediate appointment could be made for a 14″ x 17″ film at the retake center. This confirmatory film was taken, developed, and interpreted as quickly as possible. The earlier suspicion was verified, and because of the urgency of ruling out or establishing a diagnosis of cancer of the lung, the film reader telephoned the physician the patient had named. A messenger was dispatched with the 14″ x 17″ film and the survey epidemiological history and film interpretation. These were in the office of the physician within an hour or so following the telephone conversation. Under usual circumstances, a notification would have been mailed to the person, advising him to consult his physician. In this instance, however, the private physician decided that he would assume the responsibility of getting in touch with the patient immediately so that diagnosis could be established without delay.

The promptness with which this matter was handled was later reported to be in all probability a real factor in saving the patient's life. When the physician telephoned him to urge an immediate check-up, he learned that the patient was planning to leave the following day for a month's vacation. After interpretation, the patient was prevailed upon to postpone his vacation. The diagnosis of bronchogenic carcinoma was made, the patient hospitalized, and surgery performed. It was only a matter of a few days from the time this individual had a 70-mm. survey film to the establishment of diagnosis and subsequent surgery. Before this particular survey ended, he had recovered and was back on his job.

The disposition of suspects after they have had 14″ x 17″ confirmatory films at the retake center has been planned in each survey area according to the particular local pattern of medical practices and facilities. Ordinarily, tuberculosis suspects have been referred to their own physicians for diagnosis or to the health department clinic if they were unable to pay a physician. In Minneapolis, where diagnostic service was available in the health department clinic on a very liberal basis, the medical committee adopted a policy whereby all persons whose 14″ x 17″ films indicated need for futher study could be referred to the clinic without regard to economic status if they so desired. Even under these circumstances, only 30 percent of the per-

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sons referred for diagnosis went to the clinic. The remaining 70 percent chose to go to private physicians. As mentioned before, in Denver a special diagnostic clinic was established as a part of the survey. There was no retake center as such, and all persons whose 70-mm. films suggested tuberculosis were referred to the diagnostic center where 14″ x 17″ films were taken, and in addition, bacteriological examinations, tuberculin tests, physical examinations and such other measures as were necessary to establish at least a presumptive diagnosis were taken before patients were referred to their own physicians (*4*).

Decisions about practices which may affect the ordinary follow-up procedure of the official health agency must be worked out with the health officer. For example, the medical committee, in order to instruct patients and their families in isolation techniques and in following physicians' directions, may recommend an increase in the use of public health nursing services by the private physicians. This service is available from the health department to all tuberculosis patients and their families, but frequently it is not used to its fullest extent. If the medical committee takes the initiative in advising wider use of public health nursing services, the health officer and his staff will have to determine whether nursing personnel is adequate to undertake the additional load. The committee can then bring this service to the attention of the medical association, so that all physicians in the community can be informed about it.

In large metropolitan centers, the facilities and resources of the health department are often not used by general practitioners to the same extent as they are in smaller communities. Repeatedly, surveys have stimulated physicians to use the official health agency services far more than they were accustomed to doing before, because there is a better understanding and acceptance of the role this agency can play in assisting them by providing services to patients. Once a need is demonstrated, inadequacies in services are more likely to be corrected, especially when there is support from physicians in private practice. There have been instances in which more public health nurses have been added to the staff, medical social services have been developed or reorganized, laboratory services have been enlarged, or case register procedures revised and streamlined.

The committee on management has often assembled in the form of a booklet the accepted recommendations for good practice in the diagnosis and treatment of tuberculosis and other diseases receiving special consideration in the particular survey. These booklets have been distributed to all physicians in the community, so that they could have the benefit of the thinking of members of the committee. One recommendation which has always been included is that all tuberculosis suspects should be classified according to the standards

set forth by the National Tuberculosis Association.[2] The need for a complete physical examination, sputum and tuberculin tests, differential diagnosis, especially with regard to neoplasm, is reviewed in this booklet, making it useful to the physician as a reference. Epidemiological information is often included, and good public health practice in the management of suspected tuberculosis has been stressed as being exceedingly important.

As was pointed out earlier, plans for follow-up of cardiovascular and nontuberculous chest disease suspects must be carefully developed by the medical committee. In cities where there are heart and cancer associations, these groups have always been invited to participate with the survey medical committee in planning for diagnosis and care of cardiovascular and nontuberculous suspects. Those persons who have a private physician are referred back to him. For those who cannot afford private medical care, and experience has shown this to be 20 to 30 percent of the total number of all suspects, the medical committee often determines a way for diagnosis and treatment to be provided. If there are public heart disease and cancer clinics in the community, there is no problem. If there are not, out-patient departments of hospitals, clinics, and other diagnostic services in the community should be made aware of the fact that the screening program will produce a certain increase in the number of persons who will need their services. Members of the medical committee take an active part in working with the clinics to develop practical plans for referral of survey suspects.

All survey suspects referred to a doctor's office or a clinic for diagnosis and treatment should receive such service and should be followed as long as necessary. This involves several activities on the part of the patient and others: (1) Getting the patient to the physician, (2) interpreting the necessary diagnostic procedures in ways that he will understand and accept, (3) having available the necessary specialized knowledge and resources at the doctor's office or some other diagnostic facility, (4) keeping the patient under observation and following the recommended procedures as his particular condition requires, (5) effecting any adjustments in his social situation which will enable him to follow through on the diagnostic procedure.

The official health agency, through its nursing division, has means of assisting the medical profession in following through with tuberculosis suspects to see that they are placed under medical care. In many cities, however, because of the shortage of nursing staff, it is not possible for the health officer to provide the same type of nursing

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[2] National Tuberculosis Association: Diagnostic Standards and Classification of Tuberculosis, 1950. Because of the recommendations of this committee, the film readers, in recording their interpretations, frequently indicate their impression of the type and extent of the disease, and when possible, the probable activity of the process.

follow-up work for cardiovascular and nontuberculous chest diseases suspects. When that is the case, the medical committee takes the responsibility for finding other resources in the community which can be drawn upon for this service. In a California community, funds were made available through the Division of Chronic Disease of the State Department of Public Health so that extra nurses could be employed to do this type of follow-up work. In Boston, the cancer society made an appropriation for follow-up of neoplasm suspects. Heart associations in other areas have made similar grants.

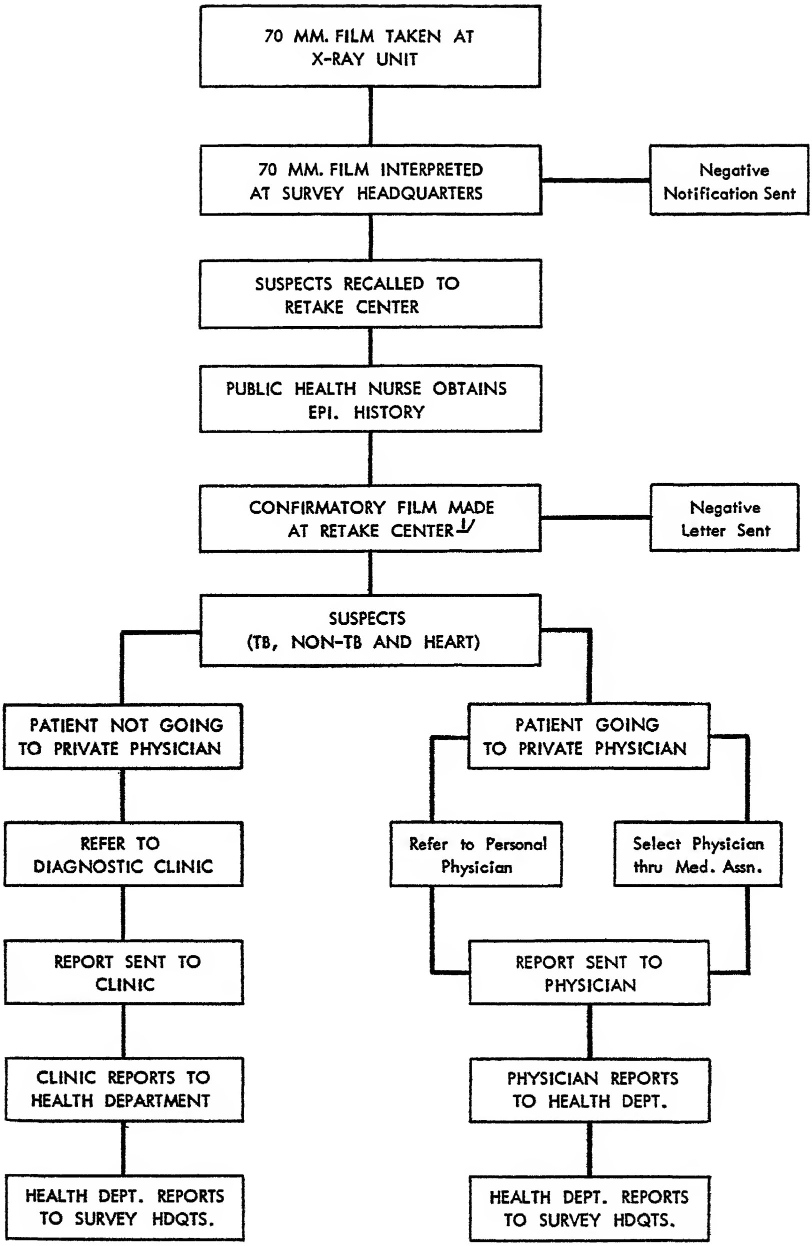
When patients are referred to a private physician or diagnostic clinic, reports of the X-ray interpretation are sent to the doctor in advance of notification to the patient recommending that he visit his doctor. If the notification to the patient is mailed at the same time the report is sent to the doctor, in many instances the patient would visit his doctor before the X-ray interpretation had arrived. All reports are based solely on survey film impressions and should not be construed as definite diagnoses. The confirmation or denial of the survey film interpreter's impression is ascertained at the physician's office or clinic. The 14″ x 17″ confirmatory X-ray film is available to the physician upon request. Whether it is temporarily loaned or given to the doctor to keep depends upon local policy.

Local medical committees have always advised that physicians send reports on all referrals to the health department as soon as diagnosis is made. This is routinely done for tuberculosis, but in a survey of this kind it is important that diagnoses of other chest diseases and cardiovascular conditions also be reported so that survey records can be closed. The health department shares necessary statistical information with the survey medical group if studies are to be made. It has been the policy for all records and X-ray films to be turned over to the official health agency when the survey is over.

Figure 1 is a typical flow chart which illustrates the steps from the time the 70-mm. chest X-ray film is taken at an X-ray unit to the time a diagnosis is reached.

Film Interpretation and Consultation

This committee has functioned as a consultation group, contributing their judgment to the interpretation of 14″ x 17″ confirmatory chest films. The committee is usually a large one, made up of radiologists, phthisiologists, surgeons especially interested in diseases of the chest, internists, and general practitioners. In order to carry out its continuing work through the period when films are being taken it has been found necessary for the committee to be organized into a number of panels. A radiologist, a tuberculosis specialist, and another physician, for instance, might constitute a panel, although the makeup of the panels varies from community to community. Panel meetings



[1] 14" x 17" confirmatory film not made on cardiovascular suspects.

Figure 1. Diagram showing disposition of suspects. Charts similar to this have been used in most of the booklets prepared by survey medical committees for distribution to practicing physicians.

are scheduled for once or twice a week, and the several panels are rotated, to avoid too heavy a demand on any one physician's time.

It has been customary to present all 14″ x 17″ confirmatory chest films to a panel at the outset of film reading. This practice, however, has almost always changed after a few panel meetings, and the doctors have requested that only certain films—those which present difficult diagnostic problems, special or unusual cases—be brought to their attention.

All physicians in the community have been invited to film interpretation panel meetings, whether they were serving officially or not. As a rule, the first meetings are attended only by the physicians scheduled, but interest in the work quickly mounts. Soon the attendance is swelled not only by doctors who come to sessions other than those on which they serve officially, but by colleagues who have heard about the panel discussions, and come for the opportunity offered. Physicians have often expressed appreciation of this chance to see many interesting films and to discuss them with other doctors. In a short period of time they can see and discuss a number of X-rays of unusual conditions which they might not otherwise encounter in years of practice. This is particularly the case for physicians who are not practicing in radiology or chest disease.

Medical Information

In many communities this committee has been the one responsible (1) for interpreting the survey to the medical profession and keeping them informed of its progress, (2) for stimulating physicians to take active part as members of a large number of community organization committees, (3) for disseminating the information assembled by the professional services division to all physicians in the community, and (4) for providing general approval of public information and publicity materials. Some members of this committee have been doctors who have experience in the field of public information and writing: in Boston, the editor of the New England Journal of Medicine; in Cleveland, a physician who writes a respected health column in a daily newspaper.

While it would not of course be feasible for every piece of survey publicity material to be cleared by the committee, they do set over-all policy at the beginning and indicate the general tone of survey messages. After that, the publicity workers check material with the Public Health Service medical officer who is responsible for making sure that statements are medically correct and acceptable to the medical committee. If there is need of clearance for specific items the medical officer brings them to the attention of the committee.

Interpretation of the survey to physicians in the community is directly the responsibility of the committee on information. Practices

vary in different cities, but a usual first step is a letter to all doctors practicing in the community, explaining the purposes of the program and the participation of private physicians with other groups in carrying out these purposes. To keep members of the medical profession informed and foster their interest, newsletters or progress reports are usually sent to them periodically throughout the survey, and articles about tuberculosis and the case-finding program are prepared for the medical society bulletin.

One of the most effective ways of enlisting the support and interest of a great many physicians is through the personal contacts of all physicians who work directly with the survey. They are able to reach a great number of their colleagues in meetings of hospital staffs, chapters of the medical society, and specialty societies, as well as in their daily contacts. Tuberculosis institutes for physicians, at which recognized local and national authorities have presented papers on various aspects of tuberculosis diagnosis and therapy, have been conducted in connection with some surveys.

The booklet or reference file for physicians, described above, is edited and distributed by the information committee. The work of all sections of the survey professional services division is described, nursing and social work as well as medical. The various forms used in referring suspects for follow-up may be printed in the booklet, so that physicians will be familiar with them. When it is prepared early and distributed as soon as 70-mm. operations begin, the medical booklet has proved more useful in giving the medical profession full information for reference in caring for patients referred to them by the survey.

After survey policies have been determined, the medical information committee reviews the form letters which will be sent to physicians transmitting reports of X-ray interpretations, as well as letters recalling individuals for 14″ x 17″ films. Great care has been taken in the wording of these letters to avoid apprehension on the part of persons receiving them.

The medical profession in each community where the Public Health Service has participated in a chest X-ray survey has exhibited intense interest in the project as well as in the problems of carrying through the activities the survey sets in motion. They have given generously and enthusiastically of their time, energy, and professional knowledge, to make the surveys a substantial contribution to the health of their communities.

The Official Health Agency

A successful community-wide chest X-ray survey requires the active leadership of the local health officer. In this intensification of tuberculosis case finding, the health officer and the tuberculosis control officer have an important role. They are responsible to the community

for control of tuberculosis, and they have the fullest knowledge of the resources in the community for combating the disease. The procedures to be observed in providing public health follow-up to tuberculosis suspects discovered in the survey are the same as they would be for suspects discovered in any other way. Although no major changes are made in health department functions during the survey, the practicability of adjustments to take care of a temporarily increased case load must be determined by the health officer.

The health department is one of the sponsors of the survey, and the health officer begins his planning long before the first X-ray is taken. On the basis of figures from other surveys, the Public Health Service medical officer is able to help him estimate the number of suspects the survey will find. Working from that estimate, he considers how to plan for medical and public health nursing service, clinic, and laboratory facilities, so they will be available as they are needed.

A certain proportion of tuberculosis patients discovered in the survey will require continued public health nursing services, and arrangements may have to be made to provide for an increased number of nursing visits. The health officer and the nursing director are in the best position to determine what can be done in these areas (*2*).

Experience in past surveys has shown that 20 to 30 percent of the suspects will be referred to the health department clinic. Of these, a considerable number will need only one visit to the clinic, with annual or semiannual supervision thereafter. The number of clinic hours per week will probably have to be increased and staff for the clinic sessions expanded for a period which will depend upon the case load resulting from the screening. To augment the clinic medical staff, the health officer can frequently get help from the medical committee of the survey in arranging for physicians to serve in the clinic at minimum fees or without pay.

In surveying laboratory facilities, the needs of both the clinic and the private physician are considered, as well as the question of whether private laboratories will be able to handle all bacteriological studies for private physicians' cases or not. Temporary changes in health department laboratory work and more extensive use of State laboratories are solutions that have been found possible in some survey cities.

Revision of the records system as it relates to tuberculosis activities and of the tuberculosis case register itself are often necessary for a survey (*5*). In many areas a more effective system has been initiated as a result of evaluation and improvement of records procedures.

Many official health agencies also have available in their departments the professional services of health educators and medical social workers. It is easy to envision the role that health educators play in a program of this kind, since success is largely dependent upon

the extent of community participation, which can be secured only through thorough organization and intensive education. In most communities the health officers have assigned the members of their health education staff to work fulltime with the survey. The need for this type of service cannot be overemphasized.

The contribution of medical social workers is also important. Many health departments still do not have medical social services for their patients and communities. In several areas where surveys were conducted, however, a genuine effort has been made by the official health agency to secure the services of medical social workers; in others, where such services were available, their integration with the case-finding program was a reality. With two exceptions health departments in survey areas have been able to establish or enlarge their social service facilities, once the need for social service work was demonstrated during the survey.

Although in many places the tuberculosis sanatoria are not directly under the jurisdiction of the health department, the health officer is of course concerned with the problem of beds for tuberculosis patients. Here, too, he works closely with the medical committee of the survey, as well as with the medical society and sanatorium authorities, in trying to arrange for hospitalization for patients who need it. In some instances, additional tuberculosis beds have been made available, or staff has been obtained so that beds not in use could be reopened. Revision of sanatorium admission policies may result in better selection of patients for hospitalization and increase the effectiveness of the sanatorium in tuberculosis control.

During the actual survey operation, the health officer gives continuous leadership. As a participant and an advisor, he works closely with the medical committee on common problems. He explains and interprets public health and tuberculosis control and is able to enlist new support from the medical profession for many of his activities. Health officers have found that surveys, with their accompanying focus of the whole community on a health problem, have brought increased interest, understanding, and support of the health department and of public health in the community.

Public Health Service Medical Officers

The Public Health Service medical officer in charge of a communitywide chest X-ray survey team has three major areas of responsibility. He is a consultant to the local official health agency and to other persons and organizations in the community in matters pertaining to the survey; he is a member of the survey organization medical committee, and the representative of the Public Health Service in the over-all survey organization; and he is the executive officer of the

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personnel from the Division of Chronic Disease and Tuberculosis in the area doing survey work.

As a consultant, the medical officer can play an important role in the initial planning for the survey, working with the health officer, the tuberculosis control officer, representatives of the medical society and the tuberculosis association, and others concerned with preparations for the program. He can describe in detail the general pattern of community-wide chest X-ray surveys as it has taken form in other places and explain the nature and extent of Public Health Service participation.

The committee can draw upon the experience accumulated by the medical officer in evaluating community resources and estimating needs. For example, the distribution of findings in various communities has shown a marked consistency which allows the planning group a basis for making reasonable estimates of the number of suspects that will be found (fig. 2).

When specific problems are considered, the medical officer is able to describe not only the way other areas have solved them, but also the settings in which those solutions were practical, so that the health officer and others have a good basis upon which to judge their practicability in the particular jurisdiction. If consultation in other professional areas, such as nursing or medical social work or records systems, is requested by the local authorities in connection with the survey, the medical officer can usually arrange to make this available.

While the survey is in operation, the Public Health Service medical officer is at survey headquarters and acts as liaison between the survey staff and both the health department and the medical committee. His constant and close association with the health officer insures effective integration of survey activities with established public health practice in the community.

As a member of the official survey organization, the medical officer not only represents the Public Health Service, which is one of the survey's sponsors, but is able to bring directly to the attention of the survey governing body problems which require immediate action.

All of the Public Health Service personnel working on a survey, including consultants from the Division of Chronic Disease and Tuberculosis who may have been in the community for considerable periods before the survey, are responsible to the medical officer in charge. As the executive officer of the team the medical officer coordinates the work of the consultants and is the person through whom all arrangements between the division or its personnel are made with local agencies or groups.

A Public Health Service survey team for 18 small film units usually includes four physicians in addition to the medical officer in charge. These doctors have had special training in survey film

TOTAL NUMBER OF 70 MM. X-RAYS TAKEN . . . 100,000

NEGATIVE 70 MM. FILMS 96,000

PERSONS WHO WILL NEED FURTHER STUDY
(4% OF TOTAL X-RAYED). 4,000 4,000

CARDIOVASCULAR SUSPECTS [1]
(0.5% OF TOTAL X-RAYED) 500

PERSONS TO BE RECALLED FOR 14" x 17" FILMS 3,500 3,500

NEGATIVE 14" x 17" FILMS (30% OF TOTAL 14" x 17") 1,050

PERSONS WHO WILL NEED FURTHER STUDY
(70% OF TOTAL 14" x 17") 2,450 2,450

TUBERCULOSIS SUSPECTS (70% OF POSITIVE 14" x 17") 1,715

NONTUBERCULOUS CHEST DISEASE SUSPECTS
(30% OF POSITIVE 14" x 17") 735

[1] It has been the recommended practice not to give 14" x 17" chest films to cardiovascular suspects.

Figure 2. Formula for estimating findings in community-wide chest X-ray survey. The percentages used above have been repeatedly observed, with slight variations, in the surveys in which the Public Health Service has participated.

interpretation and they are fully acquainted in each survey with the recommendations of the local medical committee. For purposes of uniformity and expedience a "reading code" has been established and is used by all film readers. This film interpretation code-index allows the physicians reading the photofluorograms to enter on the X-ray identification card a number which expresses the reader's impression and will be translated in the records department. The various types of pathological conditions have been grouped together according to anatomical or systemic entities in a fashion which makes it possible to cover practically all needs of survey film reading. If, for instance, the doctor enters in the record the following figures: 925, L. U.—601, the code is translated by specially trained personnel in the records department to read as follows: "Pulmonary tuberculosis; reinfection type with single cavitation in left upper lobe; calcified mediastinal nodes present." Such a reading, sometimes enlarged upon by the interpreters, is fairly typical of the information which is sent to the physician named by the individual.

If survey production is consistently higher than expected, extra film reading personnel may be requested from the Public Health Service or secured locally. To expedite the work at periods of peak activity, local health department physicians have helped with film reading in some of the larger surveys.

The film reading room is usually the meeting place of the panels of doctors on the film interpretation committee and a list of notable films, with corresponding probable diagnoses, is maintained so that panel members and other physicians can have easy access to them. There is always considerable interest in the reading room and its operations. On some occasions, visiting physicians from foreign countries have spent days or weeks observing the techniques of film reading and it is usual to have medical visitors from outside the community stop in. In one survey, a State radiologist came in to use survey films to train some of his own staff doctors. On frequent occasions a radiologist from the Division of Chronic Disease and Tuberculosis of the Public Health Service visits the X-ray team to consult with the film readers.

* * * * * * *

The "physician" in a tuberculosis survey is not a single person. He represents the accumulated knowledge and experience of many—the private practitioner, the health officer, the public health officer, the sanatorium director, the film interpreter. A private practitioner who played an active role in one of the surveys said in an article addressed to his colleagues, "You are the key to the success of the present program and the guarantee that in the future the ground gained in the fight against tuberculosis will not be lost."

ACKNOWLEDGMENT

The author wishes to express his appreciation to all of the physicians with whom the Public Health Service has had the privilege of working in chest X-ray surveys—the private physicians, the health officers and other public health physicians, the sanatorium directors, the officers and members of medical societies. It is from their experience, as well as his own, that this paper was written.

REFERENCES

(*1*) Community-wide chest X-ray survey. I. Introduction. Pub. Health Rep. **65:** 1277–1291 (1950).
(*2*) Bryant, Zella, and Jones, G. S.: Community-wide chest X-ray survey. II. Nursing. Pub. Health Rep. **65:** 1573–1587 (1950).
(*3*) Bloom, Sophia: Community-wide chest X-ray survey. III. Social Work. Pub. Health Rep. **66:** 139–156 (1951).
(*4*) Reisner, D., and Rikli, A.: Community-wide chest X-ray survey. IV. Diagnostic Clinic. Pub. Health Rep. **66:** 423–443 (1951).
(*5*) Enterline, P., and Sauer, H.: Community-wide chest X-ray survey. VI. Records and Reports. Pub. Health Rep. **66:** 1613–1624 (1951).

Community-Wide Chest X-ray Survey

VI. Records and Reports

By PHILIP E. ENTERLINE, B.B.A. and HERBERT I. SAUER, A.B.*

A community-wide survey is soon to begin. Large numbers of people will be interviewed, X-rayed, recalled for further interviews, further X-rays. Hundreds of letters must be written, records systems reviewed, new systems devised and maintained, personnel needs determined. Pertinent facts about the people in the community, age distribution, predominant racial groups, degree of industrialization, are needed. The personnel available, the records now in use, the follow-up procedures, all must be analyzed and coordinated with new needs arising from this mass survey.

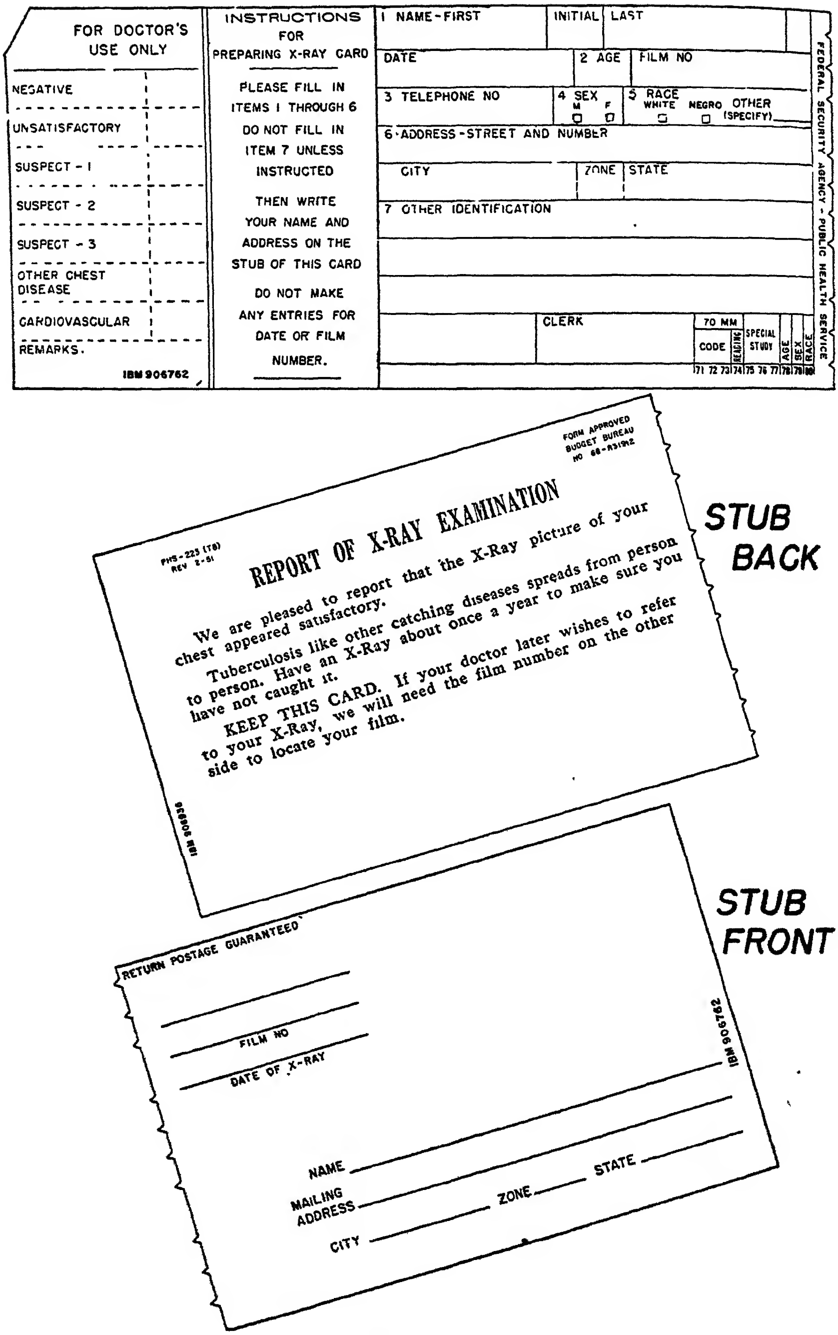
The Health Department Records Consultant

The local health department is often able to adapt its records procedures to meet many of the new needs. But if assistance is needed, upon request made through the State health department, the United States Public Health Service is usually able to help by assigning a records consultant. This consultant, who usually joins the local staff several months before the survey starts, can help the health department prepare the tuberculosis case register for the increased load which will result from the survey. The consultant can also assist in developing any special procedures that will be needed for the follow-up of persons shown by the X-ray survey to have evidence of possible tuberculosis.

Survey Records Supervisor

Several weeks before the survey starts, the Public Health Service assigns a records supervisor directly to the survey organization. This person serves as chief of the records unit for which he recruits, trains, and supervises the clerical personnel needed to carry out the unit's duties. These duties mainly are to process all survey records and to send notifications to participants, and X-ray results to physicians and, if tuberculosis is suspected, to the health department. The records consultant also assists in designing survey form letters, helps develop records of follow-up procedures for suspected chest abnormalities other than tuberculosis, and also helps develop case-referral procedures for chest abnormalities including tuberculosis.

*Public Health Advisor Specialists, Division of Chronic Disease and Tuberculosis.



FOR DOCTOR'S USE ONLY

NEGATIVE

UNSATISFACTORY

SUSPECT - 1

SUSPECT - 2

SUSPECT - 3

OTHER CHEST DISEASE

CARDIOVASCULAR

REMARKS.

IBM 906762

INSTRUCTIONS FOR PREPARING X-RAY CARD

PLEASE FILL IN ITEMS 1 THROUGH 6

DO NOT FILL IN ITEM 7 UNLESS INSTRUCTED

THEN WRITE YOUR NAME AND ADDRESS ON THE STUB OF THIS CARD

DO NOT MAKE ANY ENTRIES FOR DATE OR FILM NUMBER.

1 NAME-FIRST | INITIAL | LAST

DATE | 2 AGE | FILM NO

3 TELEPHONE NO | 4 SEX M F | 5 RACE WHITE NEGRO OTHER (SPECIFY)

6 ADDRESS-STREET AND NUMBER

CITY | ZONE | STATE

7 OTHER IDENTIFICATION

CLERK | 70 MM CODE | READING | SPECIAL STUDY | AGE | SEX | RACE

71 72 73 74 75 76 77 78 79 80

FEDERAL SECURITY AGENCY - PUBLIC HEALTH SERVICE

FORM APPROVED BUDGET BUREAU NO 68-R319R2

PHS-225 (TB) REV 2-51

REPORT OF X-RAY EXAMINATION

We are pleased to report that the X-Ray picture of your chest appeared satisfactory.

Tuberculosis like other catching diseases spreads from person to person. Have an X-Ray about once a year to make sure you have not caught it.

KEEP THIS CARD. If your doctor later wishes to refer to your X-Ray, we will need the film number on the other side to locate your film.

IBM 906836

STUB BACK

RETURN POSTAGE GUARANTEED

FILM NO

DATE OF X-RAY

IBM 906762

NAME

MAILING ADDRESS

CITY | ZONE | STATE

STUB FRONT

Figure 1. X-ray card used at the time the 70-mm. film is taken.

Survey Procedure

Radio, television, newspapers, pamphlets, posters have alerted the community, the survey staff is ready, the record forms are in order, the X-ray machines are set: the survey begins.

The 70-mm. X-ray

As each person approaches the screening unit he is met by a clerk who writes in identifying information, items 1–6, on the X-ray card. (See fig. 1.) (These cards are supplied by the Public Health Service if desired.) If the X-rays are being taken of a group of persons, such as those in a school or factory, the participants may be asked to fill out their own cards. An effort is made to avoid any questions which may discourage people from participating in the survey.

In some instances, entries may also be made under item 7—"other identification." For example, if the person being X-rayed is required by law to take an annual chest X-ray this can be noted, and later a report can be made available to the health department so that the survey film may be used as the required X-ray.

The participant next hands the completed card to the X-ray technician who stamps on both the card and stub a seven-digit number of which the first two digits refer to the X-ray unit, the last five to the individual X-ray film. This enables each X-ray unit to have its own series of numbers, thus preventing duplication of any film number.

The card is then inserted in the "photo identifier" of the X-ray machine in order to photograph on the film the subject's last name, age, sex, race, and film number. This not only provides positive identification, but allows the film reader to consider pertinent data, when evaluating the film, without referring to the X-ray card. The X-ray is then taken.

Notifying Participants of the Results

After the rolls of film are developed, they are matched with the X-ray cards. Both cards and film are then sent to the film reading room where a physician reads the films and enters his impressions on the cards. The stubs of the X-ray cards (fig. 1) are mailed to notify those whose small films are negative. Those whose X-rays are technically unsatisfactory, either because they moved during the X-ray exposure, or because of mechanical failure of the machine, are asked by post card to have another film taken at any of the survey units. Those persons whose small films suggest positive findings and the need for further study, receive a personal letter notifying them of an appointment at the survey retake center.

Epidemiological Record and 14" x 17" Confirmatory Film

An epidemiological record (fig. 2) is initiated for persons for whom

an appointment is made at the retake center. Lines 1–4 of the record are filled in from the original X-ray card, the appointment date is entered, and the card is then filed alphabetically and by appointment date at the retake center. A somewhat different record is usually

NAME: *(Last)* *(First)* *(Middle)* *(Maiden)*
1.
APPOINTMENT DATES
1)
2) 4)
3) 5)
ADDRESS *(House Number)* *(Street)* *(Apt No.)* *(City)* *(Zone)* *(State)*
2.

DATE OF BIRTH	AGE	SEX	RACE	MARITAL STATUS	HOME PHONE	BUSINESS PHONE
3.						

70MM NO.	DATE	READING	REMARKS
4.			

5. NAME OF EMPLOYER ________ ADDRESS ________
6. PRESENT OCCUPATION ________ NUMBER OF YEARS ____ PREVIOUS OCCUPATION ________ NUMBER OF YEARS ____
7. NUMBER IN HOUSEHOLD. TOTAL ____ ADULTS (over 15 yrs) ____ CHILDREN ____ RECENT CHANGE IN WEIGHT ____
8. RECENT ILLNESS ________
9. REMARKS: ________
10. HAVE YOU EVER HAD A CHEST X-RAY BEFORE THIS SURVEY? No ____ Yes ____ Date ____ Place ____ Results ____
11. HAVE YOU EVER HAD TUBERCULOSIS? No ____ Yes ____ What year ____ TREATMENT None ____ Pr Phy ____ Clinic ____ San. ____
12. REMARKS: ________
13. HAVE YOU EVER BEEN IN CONTACT WITH ANYONE WHO HAD TUBERCULOSIS? No ____ Yes ____ WHEN (Dates) ____ To ____
14. TYPE OF CONTACT: Casual ____ Close ____ NAME OF PRIVATE PHYSICIAN ________
15. ADDRESS OF PRIVATE PHYSICIAN ________

NOTES: ________

REGISTER INFORMATION
NOT KNOWN ____ KNOWN ____
DATE ORIGINAL REPORT ____
DATE LAST REPORT ____
DIAGNOSIS ____
SUPERVISION ____
REMARKS: ____

FRONT

FILM IMPRESSION

14 X 17 FILM NO.	DATE	CODE NUMBER(S)

		70MM REVIEW	CON-FIRMA-TORY
N	ESS. NEGATIVE		
T	MINIMAL TBC		
	MOD. ADV. TBC		
	FAR ADV. TBC.		
	OTHER TBC		
S	SUSPECTED TBC.		
O	OTHER CHEST DISEASE		
C	CARDIOVASCULAR		

REMARKS.

70MM REVIEW REMARKS:

FOLLOW UP: URGENT ☐ ROUTINE ☐ NONE ☐

REPORT TO HEALTH DEPARTMENT

DIAGNOSIS	ACTIVITY	BACTERIOLOGICAL EXAMINATION	TUBERCULIN TEST(S)
TUBERCULOSIS:	(IF TUBERCULOSIS)	POS. NEG	
MINIMAL ☐	PROBABLY ACTIVE ☐	SPUTUM SMEAR ☐ ☐	POSITIVE ☐
MODERATELY ADVANCED ☐	ACTIVITY UNDETERMINED ☐	SPUTUM CONCENTRATE ☐ ☐	NEGATIVE ☐
FAR ADVANCED ☐	PROBABLY INACTIVE ☐	SPUTUM CULTURE ☐ ☐	NOT DONE ☐
TBC UNCLASSIFIED ☐		GASTRIC CULTURE ☐ ☐	
OTHER CHEST DISEASE ☐		G.P INOCULATION ☐ ☐	
ESSENTIALLY NEGATIVE ☐			

REMARKS ________

TO BE UNDER MEDICAL SUPERVISION OF: ________
SIGNATURE OF DOCTOR ________ DATE ____

PHS-107-3(TB) EPIDEMIOLOGICAL RECORD FEDERAL SECURITY AGENCY PUBLIC HEALTH SERVICE

BACK

Figure 2. Epidemiological record (suspected tuberculosis).

used if the participant is being checked for a suspected abnormality other than tuberculosis. (See cardiac record, fig. 3.)

When the person reports to the retake center, (1) his epidemiological record is pulled from the files by the receptionist, (2) he is interviewed by a public health nurse who answers any questions he may have and completes lines 3 and 5–15 of the record, and (3) a 14″ x 17″ chest film is taken. This second film is identified by the same number as that used on the small film.

After the 14″ x 17″ film is developed, it is matched with the corresponding epidemiological record and is sent to the film reading room. The film impression is entered on the record in a three digit code which eliminates the need for writing long and recurring film impressions, and makes for ease in later transcribing the film reading to other records.[1]

Appropriate letters are mailed to those persons whose confirmatory X-rays are either negative or show shadows of apparently no clinical significance.

For all persons suspected of having tuberculosis, including those who did not have a confirmatory film taken, the epidemiological records are sent to the health department to be checked against the tuberculosis case register. (When the volume of work permits, this check is preferably made before the 14″ x 17″ film is taken so that the nurse at the retake center and the large film reader can benefit by this information.) After filling out the "register information" section (fig. 2), the records are returned to the survey organization.

Two copies of the record are then typed. These are the same as the original except that the space for recording the 70-mm. film reading is omitted, 8½″ x 11″ sheets rather than 5″ x 8″ cards are used, and the 14″ x 17″ film reading is decoded. One copy is sent to the health department to advise them that a diagnosis should be forthcoming from either the person's doctor or a clinic. The second copy of the record is sent to the physician or clinic with a letter in which it is requested that the section of the record called "Report to Health Department" be filled out, and that the report be returned when a diagnosis has been established. The person is then asked to report for further examination to his physician or to a clinic, according to the information recorded in the epidemiological record. Procedures similar to the foregoing are also used for persons with possible abnormalities other than tuberculosis.

Filing 70-mm. and 14″ x 17″ Films

During and after the survey it is often necessary to refer to the 70-mm. films. The rolls of films are filed by film number; therefore, in order to find a particular film, its film number must be known.

[1] For a more complete discussion of the film reading code, see the paper on medical aspects of surveys, in this issue of PUBLIC HEALTH REPORTS.

973050—51——4

This number is obtained from either the stub of the corresponding X-ray card or the X-ray card itself.

X-ray cards for persons whose small films are negative are sometimes filed in numerical order, which is the way they are received from the X-ray units. Cards filed in this way can be of some help in

NAME: (Last) (First) (Middle) (Maiden) | 1) | 1)
1. | 2) | 2)
ADDRESS (House Number) (Street) (Apt. No) (City) (Zone) (State) | 3) | 3)
2. | 4) | 4)

Date of Birth 3.	Age 4.	Sex 5.	Race 6.	Marital Status 7	Home Phone 8	Business Phone 9.

10. Name of Employer | 11. Address | 12 Present Occupation | 13. No. Yrs.

14. Recent Illness | 15 Serious Illness | 16. Ever had a chest X-ray before this survey? ☐ No ☐ Yes
If yes, date Place Results

17. Had rheumatic fever? ☐ No ☐ Yes | 18. Ever had blood pressure taken? ☐ No ☐ Yes

19. Ever been told you have a Heart Disease? ☐ No ☐ Yes | 20. Ever been told you have a Heart Murmur? ☐ No ☐ Yes

21. Ever been rejected for a heart condition by a Life Insurance Company, Armed Forces or Employer? ☐ No ☐ Yes

22. Under physician's care? ☐ No ☐ Yes | 23 Under medical care for heart? ☐ No ☐ Yes

24. Physician's Name | 25. Physician's Address

26 Interviewer's Remarks

FRONT

FILM IMPRESSIONS

FIRST FILM | REVIEW BOARD FILM

70 mm. Film No. Date | Confirmatory Film No. Date

PHYSICIAN'S FINDINGS: AFTER STUDY, PLEASE RECORD YOUR FINDINGS BELOW AND RETURN IN SELF-ADDRESSED ENVELOPE.

1. Heart Size: ☐ Enlarged ☐ Not Enlarged | 2. Heart Disease ☐ Arteriosclerotic ☐ Hypertensive ☐ Rheumatic ☐ Syphilitic ☐ Other ☐ None | 3. Compensated: ☐ Yes ☐ No

4. Physician's ☐ Dyspnea ☐ Ankle Edema ☐ Other ☐ Angina ☐ None | 5. Has patient a history of heart disease? ☐ Yes ☐ No
If yes, what type and for how long?

6. Lab Data (EKG, X-ray, Fluoroscopy, Kahn, Urine, etc.)

7. Remarks.

THE COMMITTEE FOR CARDIOVASCULAR DISEASES
MARICOPA COUNTY CHEST X-RAY SURVEY
ARIZONA STATE DEPARTMENT OF HEALTH

Physician's Signature

BACK

Figure 3. Epidemiological record (suspected cardiovascular abnormality).

locating a film number when the individual has lost his negative notification (the stub of the X-ray card) and does not recall the number. However, an alphabetical card order is usually more desirable because it makes finding film numbers easier. Filing procedures, like most survey procedures must, of course, be based on the particular needs and resources of each community.

X-ray cards for unsatisfactory films are kept in numerical order so that they can be readily counted as a check on the number of poor films taken by each unit.

The cards of persons whose 70-mm. films are positive are filed alphabetically so that film numbers can be easily located in response to the frequent inquiries regarding this group, and to avoid making repeated appointments for persons who have a number of small films taken on their own initiative. In addition to this card file, a numerical list of these persons is kept which shows their name and film reading. This numerical list enables the survey staff to prepare reports on the findings of any X-ray unit for any period of its operation. That is, the film numbers of X-rays taken by a unit on a certain date can be checked to see which of these are also on the list of positive findings. The list also acts as a safeguard against loss of records of the positive group.

The 14″ x 17″ films are numbered and filed in the order in which they are received from the reading room. This file number, the subject's name and his film number are recorded by the survey staff on 3″ x 5″ cards which are filed in alphabetical order. These cards are used during and after the survey to locate the 14″ x 17″ films, and to record the withdrawal and the return of large films borrowed by physicians and clinics to use in establishing diagnoses.

Survey Information Reports

Reports of survey activities are prepared periodically during the survey by the records staff. The daily number of participants at each unit, the number and percent of persons whose 70-mm. X-rays are positive, the number of persons whose findings are confirmed by the 14″ x 17″ films, are all useful data—useful for scheduling X-ray equipment, for anticipating demands on both the retake center and diagnostic facilities, useful for making the community more aware of the survey activities, and for other administrative needs.

At the conclusion of the survey, the records unit prepares a final report of the survey screening operations. Subsequently, all films and records are moved from the survey organization to the local health department.

Follow-up

The health department has the responsibility for public health follow-up on persons whose survey films suggest possible tuberculosis.

As previously mentioned, a records consultant can be assigned by the Public Health Service to help the health department develop special records procedures useful in fulfilling this responsibility. The follow-up procedures for those persons whose X-rays show possible heart disease or lung cancer are determined by the local medical profession in cooperation with the health department.[2] These procedures are often similar to those used in the follow-up of persons whose films suggest possible tuberculosis.

A tuberculosis suspect register is usually established to help follow-up the large number of suspect cases that result from the screening survey. This register is based on the epidemiological records of those persons whose confirmatory films showed the need for further examination. While some of these persons need only one examination before a diagnosis is established, others may need several over a period of many months. The tuberculosis suspect register can facilitate close follow-up where it is needed and can help keep the regular tuberculosis case register from becoming overloaded.

If the patient is found by clinical examination not to have tuberculosis, or to have tuberculosis that is stable so that health department supervision is not thought necessary, the record in the suspect register is transferred to the closed file. If, however, the clinical evaluation results in a diagnosis of significant tuberculosis, the patient's record is taken from the suspect register, a morbidity report is prepared, and a record is initiated in the tuberculosis case register.

Just as before the survey, the tuberculosis case register can yield information that facilitates supervision of persons with tuberculosis, only now the register will more completely represent the community because of the cases added as a result of the survey. Answers can be supplied to such questions as: How many active and questionably active cases are there at home? Of the cases at home that are considered significant for supervision, how many and what percent have not had an X-ray or clinical examination report within the past 12 months? How many cases are closed annually as lost? (A plan for tabulating such information is given in the appendix.)

Postsurvey Records and Reports

Information from the X-ray cards, the epidemiological records, and the tuberculosis case register can be used after the survey to further serve the community. Where good population estimates are available, tabulation of the X-ray cards by age, sex, race, and residence will reveal geographical areas poorly covered and groups that did not respond, thus guiding future case finding and health education programs. From the epidemiological records can be found such things as cases discovered by the survey that were previously unknown, the

[2] This is discussed further in the paper on medical aspects of surveys in this issue of PUBLIC HEALTH REPORTS.

number of new cases who knew of previous contact with a tuberculosis patient, and the number of new cases who had not been X-rayed previous to the survey.

The extensive presurvey review of health department record procedures, the new procedures developed to handle examination and follow-up of large numbers of persons, the greater percentage of persons with tuberculosis in the community who now are listed in the register, all leave the health department with an improved record system to use in its continuing program of tuberculosis case finding and case supervision.

Summary

To summarize the methods used in processing survey records it may be helpful to describe what happens to a participant from the time he comes for the initial 70-mm. X-ray until he reaches the point in the survey process where he is referred to a physician, and to list the corresponding records procedures used by the survey staff.

MR. K GETS A CHEST X-RAY	RECORDS PROCEDURES
1. As he walks into the X-ray station Mr. K is greeted by a receptionist who fills out an identification card for him. He then walks over to the X-ray machine, hands his card to the technician who shows Mr. K the proper position to take before the X-ray machine, and takes the X-ray.	1. (a) An X-ray card is filled out. (b) An identification number is stamped on both the card and stub by the X-ray technician. (c) The card is photographed on the film. (d) The card is placed in a stack to be matched with the developed films. (e) The matched cards and rolls of film are sent to the reading room. (f) A physician examines the films and enters his reading on the X-ray cards.
2. About 2 weeks later:	2. Notifications are sent in one of the following ways, according to the interpretation:
(a) Mr. K receives a post card saying the X-ray of his chest appeared satisfactory; or	(a) The stubs are separated from the X-ray cards and mailed to those whose films are negative.
(b) Mr. K receives a post card saying the X-ray film was faulty and would he please return to any of the survey units for another film; or	(b) Post cards are sent to those whose films are faulty, requesting them to take another film at any of the X-ray units.
(c) Mr. K receives an appointment at the survey retake center.	(c) A personal letter, which includes an appointment at the survey retake center, is sent to those whose small films suggest positive findings. An epidemiological record is initiated and sent to the retake center for persons in this group.

3. Mr. K comes to the retake center where he is met by a receptionist. He hands her his appointment letter and in a moment he is called by a nurse. The nurse interviews him, answers his questions, and then shows him to a booth. He strips to the waist and steps out of the booth when his name is called by the X-ray technician. A film is taken.

3. At the retake center: (a) The epidemiological record is pulled from the files by the receptionist. (b) Lines 3 and 5–15 of the record are completed by the nurse as she interviews the patient. (c) The 14″ x 17″ confirmatory film is taken by the technician. (d) The developed films are sent with the matching epidemiological records to the reading room. (e) The films are read by a physician who enters his impressions on the epidemiological records.

4. About 2 weeks later:

(a) Mr. K receives a letter saying that the shadows noted on the small film were shown by the large X-ray to be of no importance; or,

(b) Mr. K receives a letter saying that the large film showed shadows which should be investigated further and will he please visit his physician.

4. (a) Letters of notification are sent to those whose 14″ x 17″ films show shadows noted on their 70-mm. films to be of no importance; or

(b) Where the large films indicate need for further study, the following action is taken: (1) The epidemiological records are checked against the tuberculosis case register and appropriate information is recorded; (2) two copies of each of the epidemiological records are typed. One copy is sent to a physician or a clinic, together with an explanatory letter, and the other copy is sent to the health department; (3) letters of notification are sent to the participants asking them to visit a physician or a clinic (according to information on the epidemiological records).

APPENDIX I

Tuberculosis Case Register Summary Report (all cases)

Health Department .... **Six-month period ending** ....

		Survey Cases	*Other Cases*
A.	Tuberculosis cases in current file at beginning of 6-month period (same as item F of preceding report, if any) ----------	______	______
B.	Newly reported tuberculosis cases during this period --	______	______
C.	Tuberculosis cases transferred to current file from closed file ----------	______	______
D.	Total tuberculosis cases during period (Sum: items A, B, C) ----------	______	______

	Survey Cases	Other Cases
E. Cases transferred to closed file during 6-month period. Reason for closing:		
1. Death	______	______
2. Inactive	______	______
3. Diagnosis changed to nontuberculous	______	______
4. Moved away	______	______
5. Lost, unable to locate	______	______
6. Other, specify: ______	______	______
F. Tuberculosis cases in current file at end of 6-month period (D minus E)	______	______
1. Cases in tuberculosis hospitals	______	______
2. Cases at home, active or activity undetermined	______	______
a. Sputum or other bacteriology, positive	______	______
b. Sputum or other bacteriology, negative or no expectoration	______	______
c. Bacteriological status unknown, or undetermined	______	______
3. Cases at home, probably inactive or inactive	______	______
G. Medical follow-up status of cases at home (Sum: items F2 and 3)	______	______
1. Not yet due for re-examination report	______	______
2. Overdue, last examination report within 12 months	______	______
3. Overdue, last examination report 1 year or more ago	______	______
H. Nonpulmonary cases included in item F above	______	______
I. Cases at home, active or activity undetermined (item F2)	______	______
1. Number of active cases	______	______
2. Number of cases, activity undetermined or unknown	______	______

Prepared by ______________________

APPENDIX II

Instructions for Preparing Tuberculosis Case Register Summary Report

This report is designed to be as easy as possible to prepare, usually without removing register cards from the file, and thereby not interfering with other uses of the register.

Do NOT include any suspects, contacts, calcifications or other cases which are not reportable.

Instructions for making entries:

Column entries: "Survey cases" are those cases first found and reported as a result of a community-wide X-ray survey.

"Other cases" are those cases first found and reported by other means, even though they may have been subsequently reported by the survey.

A. Enter the total number of tuberculosis cases, both pulmonary and nonpulmonary, in the current file as of the first day of the period. This would be the same figure as in item F of the previous report.

B. Enter total number of new cases reported during the period.

C. Enter here all cases transferred, regardless of reason, from closed file to current file during this period.

D. Self-explanatory.

E. Cases closed may be listed daily on a tabulation ledger or they may be counted at the end of the 6-month period, by reason for closing:

1. All deaths due to tuberculosis and deaths of all other cases transferred from the current file to the closed file during the period.
2. Whenever the health department classifies a case as "inactive, patient able to accept responsibility for recheck X-rays, close," then it should be closed, and transferred to the closed file for this reason.
3. Include those with diagnoses changed to "essentially negative" or to other pathological conditions.
4. Moved away to a specific address in another health department area.
5. Lost, unable to locate and therefore unable to continue follow-up anywhere.
6. If cases are closed for other reasons, specify the reason and the number of cases closed for each reason.

F. Count all living cases in the current file as of the last day of the period. This entry should agree with the figure obtained by subtracting E from D. *Experience has demonstrated the extreme importance of periodically reviewing the accuracy of each signal,* preferably just before counting, to insure the correctness of the tabulation obtained.

1. Enter total by counting signals.
2. Active and questionably active cases at home. Include also quiescent, probably active, and activity undetermined cases. This number should be the total of item a, b, and c, below.
   a. Sputum or other bacteriology, positive. Include all cases here whose latest sputum examination or other bacteriological examination was positive, regardless of date of laboratory report.
   b. Sputum or other bacteriology, negative. Include cases having negative sputum or other bacteriological examinations within the past year, as well as cases having a report within the past year of "no expectoration."
   c. Bacteriological status unknown, or undetermined. Include also those cases which were classified more than 12 months ago as "negative" or "no expectoration" but which have not had any more recent bacteriological reports.
3. Probably inactive. Include all cases with last diagnosis of inactive, apparently arrested or arrested tuberculosis in the current file. Probably inactive cases are kept in the current file as long as the health department deems it desirable to stress supervision and follow-up.

G. Medical follow-up status of cases at home. Enter information obtained by counting appropriate signals or cards.

H. This total may be obtained by counting signals or cards.

I. See F 2 above.

The Finnish Trambusti Tuberculin Test

—A Comparison With the Mantoux Test*—

By Phyllis Q. Edwards and Severi Savonen

Not unlike the Finnish language, the tuberculin test used in Finland is so little known outside that country that interpretation is necessary for the many persons who are not familiar with it. The present paper provides a translation of the Finnish test—a modification of Trambusti's procedure—into terms of its efficiency in relation to the more widely known intradermal Mantoux test.

Although the procedure for giving this particular type of tuberculin test has undergone various modifications during its 24-year history, the basic principle of puncturing the skin with a needle through a drop of tuberculin has remained unchanged. An American pediatrician, Chester Stewart, first described such a test in 1928 (*1*)—a technique born of his desire to test children in a way less objectionable to them than Pirquet's scarification method. Later in the same year an Italian, Bruno Trambusti, published his first paper (*2*) dealing with the test generally known by his name which differed from Stewart's in that a large caliber injection needle was used in place of an ordinary sewing needle. Subsequent minor changes in strength of tuberculin, needle size, and control test with Ringer's solution have been proposed by different investigators without noticeable effect on the popularity of the test except in Finland where it has been used extensively during recent years in the nation-wide tuberculosis-control program (*3*).

In order to relate the results of the Finnish mass BCG campaign with findings in similar mass-examination programs in many other countries throughout the world, a comparison of the Finnish Trambusti test with the more generally used Mantoux was carried out in November 1950 through the cooperation of the Finnish National Anti-Tuberculosis Association and the Tuberculosis Research Office of the World Health Organization.

The Study

Arrangements were made to give two tuberculin tests,[1] the usual Finnish Trambusti in one arm and the Mantoux in the other, during a routine retesting and vaccination program of school children in four

*From the Tuberculosis Research Office, World Health Organization, Copenhagen, Denmark, and the Finnish National Anti-Tuberculosis Association, Helsinki, Finland.

[1] Tuberculins used in this study were provided by the State Serum Institute, Copenhagen: Alt Tuberkulin, batch prepared 26/7, 1950 from lot 1.7 times stronger than the International Standard OT. PPD, freshly prepared dilution of batch RT XIX, XX, XXI, standardized against reference standard PPD.

towns near Helsinki: Tolkis, Strömfors, Lovisa and Mäntsälä. Of 727 boys and 816 girls comprising the group, about 90 percent were 9 to 15 years of age; nearly one-half had been previously vaccinated with BCG, about one-fourth had not been vaccinated, and previous vaccination was not verified in the remainder.

The present technique for giving the Finnish Trambusti test has been in official use since 1946. The radial aspect of the left forearm, about 5 cm. distal to the antebrachial fossa, is cleansed with ether before application of a drop of Old Tuberculin. A No. 12 steel injection needle (Standard S–B Brand), after being heated in a flame, is wiped with an ether sponge, attached to an empty 5-cc. syringe and inserted into the intradermal tissue tangentially, bevel upward, through the tuberculin. When the entire opening of the needle is within the skin, the needle is twisted several times, raised perpendicular to the forearm, lowered and withdrawn. The children are asked not to wipe off the tuberculin for at least 5 minutes. A small amount of bleeding occurs infrequently.

Mantoux tests were given intradermally in the mid-dorsal aspect of the right forearm, injecting 10 TU [2] of PPD in 0.1 cc. of diluent with a No. 25 platinum needle.

The Finnish Trambusti tests were given and read by Annakaisa Mörttinen, a Finnish nurse with considerable experience in the mass BCG campaign work in Finland. Grete Windfeldt, a Danish nurse from the International Tuberculosis Campaign, who during the past year has been a member of a field research team of the Tuberculosis Research Office, gave and read the Mantoux tests.

Reactions were read 3 days after the tests were given. The children went first to the Finnish nurse who, without being allowed to see the Mantoux reaction, dictated to a secretary her measurements of the transverse and longitudinal diameters of induration of the Finnish Trambusti reactions. In addition, she classified reactions as either positive or negative, according to a partially subjective method used in the Finnish mass campaign so that BCG vaccination could be offered to those she considered negative. The children then went into another room where the Danish nurse, before being allowed to see the result of the Finnish test, measured the transverse induration of the Mantoux reaction and noted any bullae, lymphangitis, or other complications of the reaction. After the Mantoux reading had been recorded by a secretary, the Danish nurse then measured the transverse induration of the Finnish test and observed any complications. She did not interpret either the Mantoux or the Finnish reactions as positive or negative. Independent readings of the Finnish Trambusti by the Finnish nurse and the Mantoux by the Danish nurse were thus

[2] 10 tuberculin units=1/5,000 mg. (0.0002 mg.) reference standard PPD=1/1000 mg. (0.1 mg.) International Standard OT.

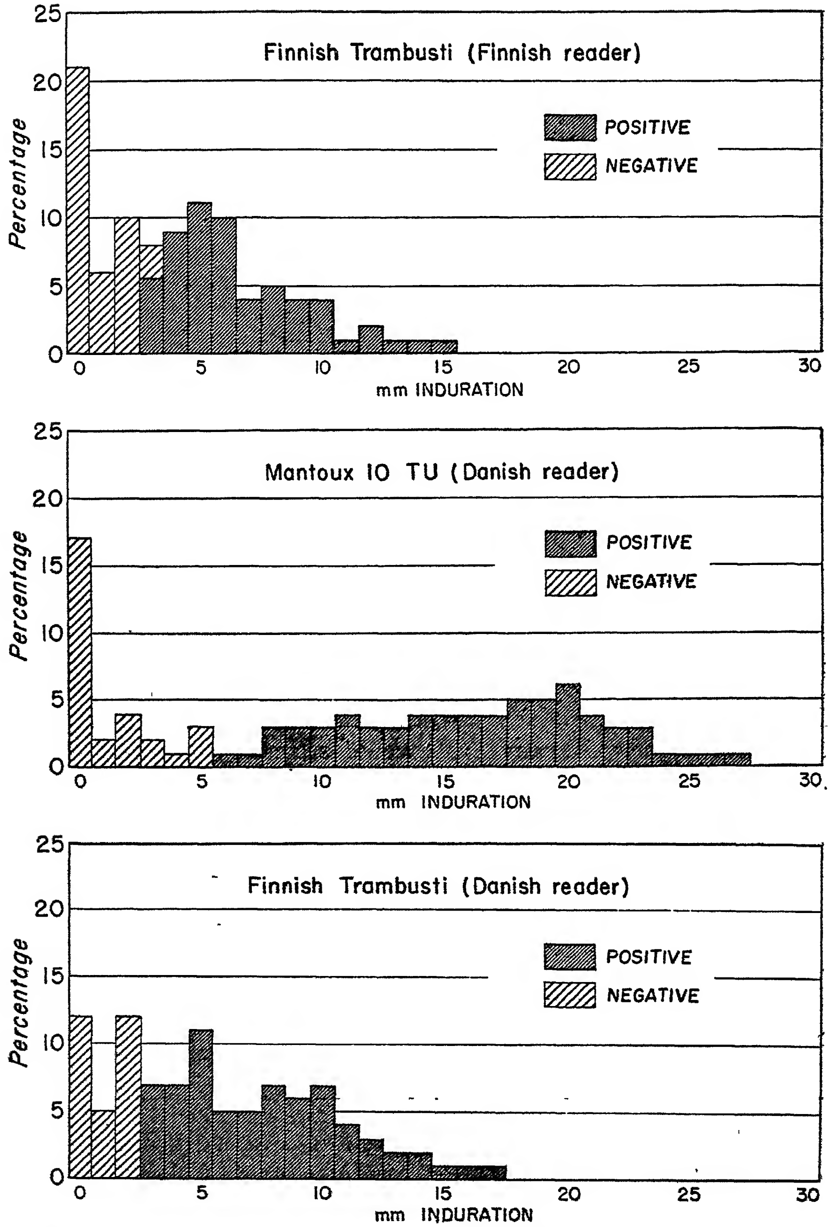


Figure 1. Frequency distribution of reactions by transverse diameter of induration to Finnish Trambusti (above, Finnish reader; below, Danish reader) and Mantoux 10 TU (center, Danish reader) among 1,543 school children given both tests in Finland, November 1950.

obtained for comparative study of the two tests. Moreover, from the measurements of the Finnish test by the Danish nurse additional information is provided for studying variations between two persons reading the same reactions.

Results

General Characteristics of the Tests

Differences in the sizes of the Finnish and Mantoux reactions are illustrated in figure 1 which shows the frequency distributions of the transverse diameter of induration. It is apparent that the Mantoux reactions cover a much broader range than the Finnish Trambusti. As measured by the Finnish nurse, a high proportion of the Finnish reactions were around 5 mm. in diameter with very few larger than 15 mm. By contrast, over one-third of the Mantoux reactions measured more than 15 mm. with a peak in the distribution at 20 mm. Comparison of the Finnish reactions shown in the upper and lower sections of figure 1, however, indicates that the Danish nurse measured induration somewhat larger than the Finnish nurse.

It is not surprising that with the larger Mantoux reactions there was a higher frequency of undesirable reactions—those with vesicles or bullae, large indurations surrounded by a soft edematous swelling of the tissues, lymphangitis, or a combination of two or more (table 1). Lymphangitis was seen only with the Finnish test and did not appear to be associated with any evidence of secondary infection at the reaction site.

Table 1. *Reactions with complications in Finnish Trambusti and Mantoux tests among 1,543 school children*

Reactions complicated with—	Mantoux		Trambusti	
	Number	Percent	Number	Percent
Bullae or vesicles	41	2.7	6	0.4
Surrounding edema	92	5.9	3	.2
Lymphangitis	0	0	6	.4
Two or more of above	32	2.1	0	0
Total	165	10.7	15	1

Classification of reactions as positive and negative is indicated by the shading in figure 1. Mantoux reactions are classified objectively by defining a positive reaction as induration of 6 or more mm. Finnish reactions are separated in the upper section of the figure into positive and negative according to the field interpretations of the Finnish nurse. In the lower section, Finnish reactions as read by the Danish nurse are classified as negative if smaller than 3 mm. in diameter.

The Finnish nurse interpreted 60 percent of her reactions as positive, all of those measuring less than 3 mm. and about one-third of those

measuring just 3 mm. being designated as negative. Except for two reactions of 4 mm., the remainder was called positive (table 2).

A very significant difference between the Finnish and Mantoux tests may be observed in the concentration of reactions near the borderline between positive and negative. For the Mantoux, relatively few reactions occur at the critical point of separation: only 4 percent measure either 5 or 6 mm. in diameter. For the Finnish test, on the other hand, a substantial concentration of reactions is at the borderline: over 18 percent measure either 2 or 3 mm. in diameter.

Table 2. *Classification of Finnish Trambusti reactions as positive or negative according to the transverse diameter of induration measured by the Finnish nurse among 1,543 school children*

Classification	Transverse diameter of induration in mm.							
	0	1	2	3	4	Over 4	Total	Percent
Negative	322	89	162	37	2	0	612	39.7
Positive	0	0	0	84	144	703	931	60.3
Total	322	89	162	121	146	703	1,543	100.0

Agreement Between the Tests

As compared with the classification of 60 percent of the children as positive tuberculin reactors by the Finnish test, 70 percent of the Mantoux reactions would be positive according to the generally accepted criterion that 6 or more mm. of induration denotes a positive. Thus, although the two tests differ by 10 percent in the frequency of positive reactors, the more critical question is how many of the *same* persons are classified as reactors by both tests. The agreement—or disagreement—between two tests may be expressed in terms of the percent of persons positive to both tests among those positive to either or both tests. As table 3 shows, 907 children are designated as positive by both tests, 179 are positive by the Mantoux alone and 24 others are positive by the Finnish test alone. Altogether, 1,110 children are classified as positive by one or both tests with agreement for 907 or 82 percent. The tests disagree in 203 children or 18 percent of the total group who might be regarded as positive, and it is of interest that almost 90 percent of the cases in which there is disagreement are children positive by the Mantoux who are "missed" by the Trambusti (appendix table 1).

The relative magnitude of the disagreement between the Mantoux and the Finnish tests may be estimated in a rather general way by referring to the result obtained by Nissen Meyer (*4*) in a study of duplicate Mantoux tests where the same dosage was given in both the right and left arms and the reactions were read independently by one person (table 4). As these duplicate tests theoretically should produce identical reactions, it is reasonable to assume that the dis-

Table 3. *Relation between reactions classified as positive and negative according to Finnish Trambusti (Finnish reader) and Mantoux 10 TU (Danish reader) among 1,543 school children given both tests, Finland, 1950*

Finnish Trambusti as classified in the field by the Finnish reader	Mantoux 10 TU (Danish reader) when 6 or more mm. of induration is a positive reaction			
	Number positive	Number negative	Total	Percent
Number positive	907	24	931	60.3
Number negative	179	433	612	39.7
Total	1,086	457	1,543	100.0
Percent	70.4	29.6	100 0	----------

Table 4. *Relation between reactions classified as positive and negative according to duplicate Mantoux tests in 714 persons* (4)

Right arm	Left arm			
	Number positive	Number negative	Total	Percent
Number positive	507	19	526	73.7
Number negative	27	161	188	26.3
Total	534	180	714	100.0
Percent	74.8	25.2	100.0	----------

agreement which occurred is largely attributable to experimental error both in giving the Mantoux test and in reading the reactions. Disagreement between the two Mantoux tests of 8 percent is analagous to the 18 percent in the present study. Thus, a fairly substantial proportion of the disagreement between the Finnish and Mantoux tests is undoubtedly due to experimental error inherent in both test procedures.

It is of interest to determine whether closer agreement between Finnish and Mantoux tests might obtain if the dividing point between positive and negative for one or both tests is moved a few millimeters in either direction. Actually, the best correspondence for the two readers is found if positive reactions are defined as induration of 3 or more mm. for the Finnish test and 10 or more mm. for the Mantoux (table 5). In this case the percentages positive are 63 and 62 with a disagreement of 15 percent for the persons called positive by either or both tests.

With the Danish nurse's reading of both tests, however, very close agreement between the two tests is found with the usual criterion for a positive Mantoux—6 or more mm. of induration—and 3 or more mm. for a positive Finnish test (table 6, from appendix table 2). In this case 70 percent of the persons tested is called positive by each test with disagreement reduced to 12 percent, a figure not far above the 8 percent disagreement found in the comparison of duplicate Mantoux tests.

Table 5. *Relation between reactions classified as positive and negative according to Finnish Trambusti (Finnish reader) and Mantoux 10 TU (Danish reader) among 1,543 school children given both tests, Finland, 1950*

Finnish Trambusti (Finnish reader) when 3 or more mm. of induration is a positive reaction	Mantoux 10 TU (Danish reader) when 10 or more mm. of induration is a positive reaction			
	Number positive	Number negative	Total	Percent
Number positive	882	88	970	62 9
Number negative	69	504	573	37.1
Total	951	592	1,543	100.0
Percent	61.6	38.4	100.0	

In order to determine if measurements of the Finnish Trambusti reactions by the Danish nurse would be influenced by her knowledge of the Mantoux reactions on the other arm, arrangements were made during the study for her to read Finnish reactions independently in one school by having each class of about 60 pupils pass through the line twice, one test being read each time (appendix table 3). The distribution of the differences between her measurements of the Mantoux and Finnish reactions in these 357 independent double readings was later compared with the corresponding distribution of her 1,186 double readings comprising the bulk of the study. It appeared that essentially no bias of the Finnish reactions was introduced by her knowledge of the Mantoux reactions.

Table 6. *Relation between reactions classified as positive and negative according to Finnish Trambusti (Danish reader) and Mantoux 10 TU (Danish reader) among 1,543 school children given both tests, Finland, 1950*

Finnish Trambusti (Danish reader) when 3 or more mm. of induration is a positive reaction	Mantoux 10 TU (Danish reader) when 6 or more mm. of induration is a positive reaction			
	Number positive	Number negative	Total	Percent
Number positive	1,017	68	1,085	70.3
Number negative	69	389	458	29.7
Total	1,086	457	1,543	100.0
Percent	70.4	29.6	100.0	

Agreement Between the Tests for Vaccinated and Nonvaccinated Children

Since the frequency and the character of tuberculin reactions observed in general population groups may be quite different from those among vaccinated groups, the present material affords an opportunity for determining whether there is a substantial difference in the agreement between the tests in vaccinated and nonvaccinated persons. When the independent readings made by the Finnish and Danish nurses are used for 406 nonvaccinated children (table 7 and fig. 2), there is a relatively low percentage of natural reactors, less

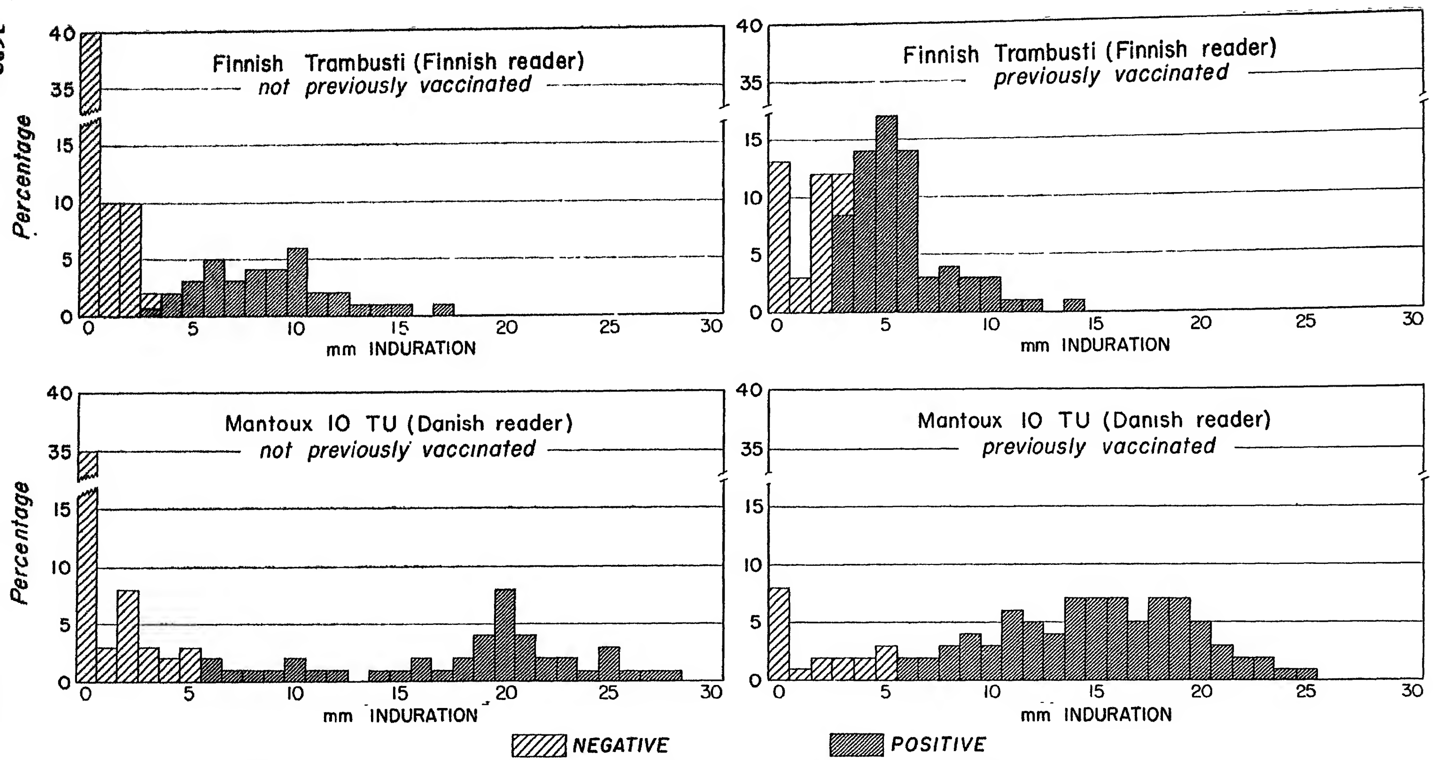


Figure 2. Frequency distribution of reactions by transverse diameter of induration to Finnish Trambusti (upper, Finnish reader) and Mantoux 10 TU (lower, Danish reader) among 406 nonvaccinated and 699 previously vaccinated school children given both tests in Finland, November 1950.

than 50 percent, with disagreement 17.6 percent among those classified as positive by either test. With a greater number of reactors, about 75 percent for 699 vaccinated children (table 8 and fig. 2), the disagreement is only a little higher—20.1 percent—indicating for both groups the problem of discriminating positive from negative when, as in the Finnish test, there is a relatively high concentration of reactions around the dividing line (appendix tables 4 and 5).

Table 7. *Relation between reactions classified as positive and negative according to Finnish Trambusti (Finnish reader) and Mantoux 10 TU (Danish reader) among 406 nonvaccinated school children given both tests, Finland, 1950*

Finnish Trambusti classified in the field by the Finnish reader	Mantoux 10 TU (Danish reader) when 6 or more mm. of induration is a positive reaction			
	Number positive	Number negative	Total	Percent
Number positive	154	3	157	38.7
Number negative	30	219	249	61.3
Total	184	222	406	100.0
Percent	45.3	54.7	100.0	----------

Table 8. *Relation between reactions classified as positive and negative according to Finnish Trambusti (Finnish reader) and Mantoux 10 TU (Danish reader) among 699 previously vaccinated school children given both tests, Finland, 1950*

Finnish Trambusti classified in the field by the Finnish reader	Mantoux 10 TU (Danish reader) when 6 or more mm. of induration is a positive reaction			
	Number positive	Number negative	Total	Percent
Number positive	468	10	478	68.4
Number negative	111	110	221	31.6
Total	579	120	699	100.0
Percent	82.8	17.2	100.0	----------

Discussion

The Finnish Trambusti test appears to possess a number of very practical advantages for mass tuberculin testing programs. It is a one-test procedure, whereas the Mantoux not infrequently must be preceded by a low-dose test in order to avoid uncomfortably large reactions in highly sensitive persons. The Finnish test, in this study, caused very few complicated reactions—just 1 percent—in contrast to over 10 percent of the Mantoux reactions which were associated with bullae or edema surrounding the induration. With respect to technique, the Finnish Trambusti is performed quickly, painlessly, and efficiently with a minimum of sterile equipment.

A most serious disadvantage of the Finnish test, however, concerns the important practical problem of discriminating between reactions which fall near the borderline separating positive from negative.

With the Finnish test this point lies approximately between 2 and 3 mm. of induration, and in the present study nearly 20 percent of all persons tested had reactions which fell in those borderline classes. With the Mantoux test, only 4 percent of those tested had reactions at the borderline between positive and negative, 5 and 6 mm. of induration. In both tests the designation of some reactions as positive or negative involves the very practical problem of distinguishing between reactions which differ by only 1 mm. in the size of induration. For the Finnish test, however, the necessity to make such a fine discrimination occurs very much more frequently, in the present study nearly 5 times as often as for the Mantoux. It might be expected, therefore, that erroneous classification due to experimental error will occur more frequently in the Finnish test than in the Mantoux.

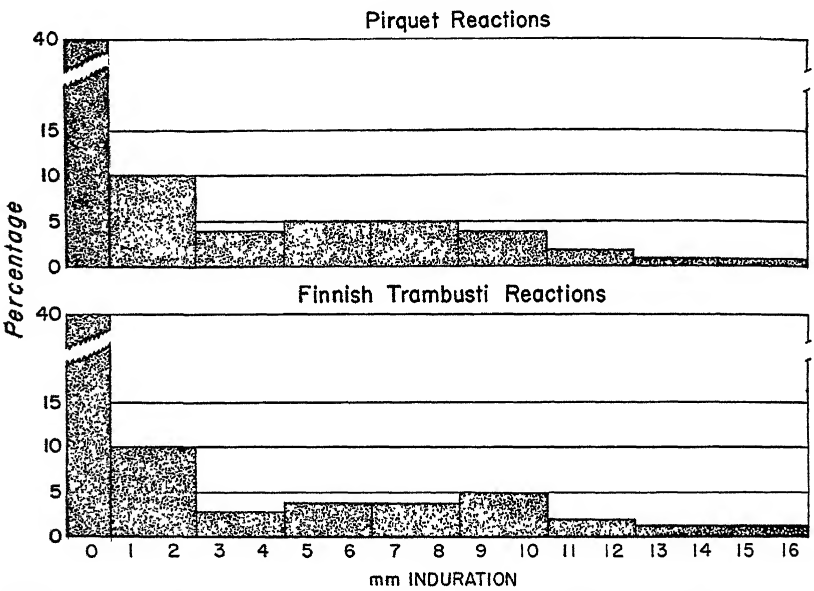


Figure 3. Frequency distribution of Pirquet reactions (above) grouped by 2 mm. classes among 11,414 nonvaccinated persons tested in Norway, 1947–48 (*6*) and Finnish Trambusti reactions similarly grouped (below) among 406 nonvaccinated persons tested in Finland, November 1950.

Another disadvantage in a test producing a fairly narrow range of reactions is the limitation in differentiating levels or degrees of sensitivity. For certain purposes it is desirable to distinguish a number of different degrees of allergy. With Mantoux reactions spread over a broad range from 0 to 30 or more mm., it is feasible to group reactions into a fairly large number of classes of sensitivity, but when most of the reactions lie within half of that range, as with the Finnish test, such groupings are necessarily more restricted.

These disadvantages of the Finnish Trambusti also apply to the

Pirquet test as pointed out in a recent paper by Nissen Meyer (*5*). The procedure for giving these two tests is technically very similar—in one the skin is punctured, in the other it is scarified, through a drop of tuberculin. Further, in size of induration there is a remarkable similarity between the Finnish and Pirquet tests as illustrated in figure 3. The upper part of the figure shows a distribution of Pirquet reactions among 11,414 nonvaccinated persons tested in Norway in 1947–48 (*6*); the lower part shows Finnish Trambusti reactions among 406 nonvaccinated children tested in the present study; the percent of reactors was about the same in the two groups. Even among nonvaccinated persons there is a relatively high frequency of reactions in both tests around the borderline between 2 to 3 mm. of induration where the critical discrimination between positive and negative reactions is made.

Summary

A comparative study of the Finnish Trambusti tuberculin test and the intradermal Mantoux 10 TU test was carried out during a routine retesting and vaccination program among 1,543 children in schools near Helsinki, Finland, in November 1950. Finnish tests in the left arm were given and read by an experienced Finnish nurse; Mantoux tests, in the other arm, were given and read by an experienced Danish nurse who also read the Finnish Trambusti reactions.

The test as used in Finland is given by inserting a No. 12 injection needle into the skin through a drop of Old Tuberculin. Mantoux tests are made by intradermal injection of 10 TU of PPD.

A substantial proportion of Finnish Trambusti reactions centered around 5 mm. of induration in the transverse diameter with almost none exceeding 15 mm.; over one-third of the Mantoux reactions were larger than 15 mm. with a peak in the distribution at 20 mm. Bullae, lymphangitis, or surrounding edema were seen in 10.7 percent of the Mantoux and 1.0 percent of the Finnish reactions.

Sixty percent of the children had positive Finnish Trambusti reactions according to the interpretation made by the Finnish nurse, whereas 70 percent was positive by the Mantoux test if the usual 6 or more mm. of induration is considered positive. Disagreement between the two tests in persons called positive is 18 percent; 203 out of 1,110 persons were positive by one test but negative by the other.

Less disagreement between the two tests is found when Finnish Trambusti reactions of 3 or more mm., read by the Finnish nurse and Mantoux reactions of 10 or more mm., Danish reading, are considered positive. By these criteria, 85 percent of the persons considered positive by either test is positive by both tests—a disagreement of 15 percent for persons called positive. With the Danish nurse's

reading of Finnish Trambusti reactions, however, the best correspondence is obtained with the usual criterion for positive Mantoux reactions of 6 or more mm. of induration and 3 or more mm. for Finnish reactions.

The Finnish Trambusti test, a one-test procedure given easily, quickly, and painlessly with a minimum of unpleasantly large reactions has certain advantages over the Mantoux 10 TU test for mass examinations in that it may obviate the need for graded doses of tuberculin and is performed with very simple supplies and equipment.

The important disadvantage of the Finnish Trambusti test, as with the Pirquet, is the difficult problem of discriminating between positive and negative in the large number of reactions that measure 2 or 3 mm. Nearly 20 percent of the cases, in contrast to 4 percent with the Mantoux, must be distinguished by a difference of 1 mm. of induration which necessarily involves considerable uncertainty due to experimental error.

REFERENCES

(*1*) Stewart, Chester: The Pirquet test—Comparison of the scarification and the puncture methods of application. Am. J. Dis. Child. **35**: 388–391 (1928).

(*2*) Trambusti, Bruno: Proposta di una nuova prova intradermica tubercolina. Boll. d. Ist. sieroterap. milanese **7**: 371–386 (1928).

(*3*) Savonen, Severi: BCG vaccination in Finland extended to the whole of the country. Helsinki, Finnish National Anti-Tuberculosis Association. 1949.

(*4*) Nissen Meyer, S., Hougen, A., and Edwards, P.: Experimental error in the determination of tuberculin sensitivity. Pub. Health Rep. **66**: 561–569 (1951).

(*5*) Nissen Meyer, S.: Tuberkulinreaksjonene som indikator for gjennemgått tuberkuløs infeksjon. Tidsskrift for Den norske lægeforening. **71**: 223–226 (1951).

(*6*) Nissen Meyer, S.: The relationship between tuberculin reaction and tuberculous infection. Pub. Health Rep. **66**: 1–15 (1951).

Appendix table 1. *Correlation of reactions to Finnish Trambusti (Finnish reader) and Mantoux 10 TU (Danish reader) by size of induration among 1,543 school children given both tests, Finland, November 1950*

Mantoux 10 TU (Danish reader) mm. induration	Finnish Trambusti (Finnish reader) mm. induration																						Total
	0	1	2	−3[1]	+	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	+20	
0	182	45	32	1	7																		267
1	18	2	7	1	1																		29
2	33	11	16		1	2	2																65
3	12	3	12	1	3		1																32
4	13	2	5	1		[2]2	1																24
5	16	6	10	3	2	2	1																40
6	8	4	5	2	3	[2]3	2	1															28
7	9	1	7	1	3	5																	26
8	8	4	11	2	4	8	2																39
9	7	3	12	3	6	3	6	2															42
10	5	2	14	4	4	11	8	3															51
11	3	2	7	3	11	12	15	3															56
12	4		4	1	6	12	6	6	2	1					1								43
13	2	1	4	3	8	15	10	3		1													47
14	2	1	7	5	7	17	17	10	2		1												69
15			4	5	5	15	20	12	2	5	3	1		1									73
16		1	2		2	13	19	18	3	5		2	1	2	1								69
17		1	2	1	2	8	13	15	5	8	2	2											59
18					6	9	21	13	6	7	4	5	1	2		2			1				77
19			1		1	3	22	23	8	7	10	5			1		1						82
20					2	4	5	21	14	12	16	13	4	3	1	4	1		1				101
21						1	4	15	3	4	9	14	3	4	1	3	5						66
22						1	1	6		6	8	9		3	2		6						42
23								9	2	9	5	3	3	1	2	1		1	1				37
24								1	3	3	2	1	4	5			2						21
25							1		2	4	2	6		1	2	3	3		1				25
26									2	2	1	4					1	2		2		2	16
27										2		2	1	1		1	1					1	9
28									1		1			2	1		1						6
29																1							1
30													1										1
Total	322	89	162	37	84	146	177	161	55	76	64	67	18	25	12	15	21	3	4	2	0	3	1, 543
				$\underbrace{37 \quad 84}_{121}$																			

[1] Indicated as positive or negative according to classification by the Finnish nurse; reactions 0–2 mm. were called negative, 4 or more mm. positive.
[2] One reaction called negative by Finnish reader.

Appendix table 2. *Correlation of reactions to Finnish Trambusti (Danish reader) and Mantoux 10 TU (Danish reader) by size of induration among 1,543 school children given both tests, Finland, November 1950*

Mantoux 10 TU (Danish reader) mm. induration	Finnish Trambusti (Danish reader) mm. induration: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	+20	Total
0	125	52	70	14	4	2																267
1	11	7	8	3																		29
2	13	12	33	5	2																	65
3	5	4	11	8	3	1																32
4	4		9	9	1	1																24
5	7	7	11	10	2	3																40
6	4	1	7	4	4	7	1															28
7	5		4	6	6	4	1															26
8	2	2	10	10	7	6	1	1														39
9	4		8	4	8	14	2	1					1									42
10	2	1	2	12	14	12	4	1	3													51
11	3		4	1	10	25	4	2	4	3												56
12	1		2	1	11	5	11	5	4	2						1						43
13	1		2	4	9	15	4	8	2	1	1											47
14	1		1	5	11	18	10	9	7	5	2											69
15			1	4	11	16	8	9	10	3	7	2	1	1								73
16				1	4	12	12	9	12	6	6	2	2	1	1	1						69
17			1		4	6	7	11	10	10	3	5	1			1						59
18					3	7	10	10	10	12	8	7	5	3	1	1						77
19					1	7	4	9	13	19	14	9	4			2						82
20						5	3	5	11	16	19	13	13	4	6	3		2	1			101
21						2		5	7	10	14	4	5	6	3	4	3	3				66
22								1	4	6	7	6	6	4	2	2	1	2			1	42
23							1		5	1	10	8	4	2	4	1	1					37
24									1	3	4	2	1	4	4		2					21
25						1			1		9	2	3	2	3	1	1	2				25
26										1	2	2	2	1	3	2			2		1	16
27										1	1	2			2	1	1			1		9
28											1	1	1	2					1			6
29																1						1
30													1									1
Total	188	86	184	101	115	169	83	86	104	99	108	65	50	30	29	21	9	9	4	1	2	1,543

Appendix table 3. *Correlation of reactions to Finnish Trambusti (Danish reader) and Mantoux 10 TU (Danish reader) by size of induration among 357 school children when both tests were read independently by the Danish reader in Lovisa, Finland, November 1950*

Mantoux 10 TU (Danish reader) mm. induration	Finnish Trambusti (Danish reader) mm. induration: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
0	33	20	24	3															80
1	3	2	2	1															8
2	6	7	8	3															24
3	3	3	3		2														11
4	2		4																6
5	2	4	5	2															13
6	2		3		1														6
7	2				1	1													4
8	1	1	4	2	1	1													10
9			1	1	2	3													7
10	2		1	5	3	2			1										14
11			3	1	3	6		1											14
12			2		1	2	1	1								1			8
13				3	1	3		2											9
14	1			2	1	4	1	1	3	1									14
15			1	2	2	3	2	2	1	1	1								15
16						3	4	2	1	2									12
17						2	1	1	1		1	2							8
18					2	2	2	1	2	3	2	2	1	2					19
19							3	3	2			2							10
20						1	1	1	5	2	4	1	2		1			1	19
21						1			3	3	2	1	1	2	1		1		15
22									2	3	1	2	1	1				1	11
23							1				2	2	1						6
24										1	1								2
25						1					4		1			1			7
26											1	1			1				3
27										1									1
28											1								1
Total	57	37	61	25	20	35	16	15	21	17	20	13	7	5	3	2	1	2	357

Appendix table 4. *Correlation of reactions to Finnish Trambusti (Finnish reader) and Mantoux 10 TU (Danish reader) by size of induration among 406 nonvaccinated school children given both tests, Finland, November 1950*

Mantoux 10 TU (Danish reader) mm. induration	Finnish Trambusti (Finnish reader) mm. induration																			Total
	0	1	2	−3[1]	+	4	5	6	7	8	9	10	11	12	13	14	15	16	+17	
0	107	22	14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	143
1	9	----	4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	13
2	19	8	5	----	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	33
3	5	3	3	1	----	----	1	----	----	----	----	----	----	----	----	----	----	----	----	13
4	6	----	1	1	----	1	----	----	----	----	----	----	----	----	----	----	----	----	----	9
5	3	2	5	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	11
6	5	2	----	----	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	8
7	4	----	1	----	----	1	----	----	----	----	----	----	----	----	----	----	----	----	----	6
8	2	1	1	----	----	1	----	----	----	----	----	----	----	----	----	----	----	----	----	5
9	----	1	2	----	----	----	1	1	----	----	----	----	----	----	----	----	----	----	----	5
10	2	----	3	1	----	2	1	----	----	----	----	----	----	----	----	----	----	----	----	9
11	----	1	----	1	----	1	----	----	----	----	----	----	----	----	----	----	----	----	----	3
12	----	----	2	----	----	----	----	1	----	----	----	----	----	----	----	----	----	----	----	3
13	----	----	----	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1
14	----	----	----	----	2	----	1	----	----	----	----	----	----	----	----	----	----	----	----	3
15	----	----	----	----	----	----	1	4	----	1	----	----	----	----	----	----	----	----	----	6
16	----	----	----	----	----	2	1	1	----	2	----	----	----	1	----	----	----	----	----	7
17	----	----	----	----	----	1	1	2	----	----	----	----	----	----	----	----	----	----	----	4
18	----	----	----	----	----	1	2	----	2	2	----	2	----	----	----	1	----	----	----	10
19	----	----	----	----	----	1	2	3	4	1	1	3	----	----	----	----	1	----	----	16
20	----	----	----	----	----	----	1	5	3	4	7	4	4	2	----	2	1	----	----	33
21	----	----	----	----	----	----	----	1	----	2	5	4	----	2	1	----	2	----	----	17
22	----	----	----	----	----	----	1	1	----	1	----	2	----	1	1	----	----	----	----	7
23	----	----	----	----	----	----	----	2	1	1	1	1	----	1	1	----	----	----	1	9
24	----	----	----	----	----	----	----	1	----	1	----	1	2	1	----	----	----	----	----	6
25	----	----	----	----	----	----	1	----	1	2	1	3	----	1	----	2	1	----	1	13
26	----	----	----	----	----	----	----	----	1	----	1	1	----	----	----	----	----	----	1	4
27	----	----	----	----	----	----	----	----	----	1	----	2	1	----	----	----	----	----	----	4
28	----	----	----	----	----	----	----	----	1	----	1	----	----	2	1	----	----	----	----	5
Total	162	40	41	6	4	11	14	22	13	18	17	23	7	11	4	5	5	0	3	406
				10																

[1] Indicated as positive or negative according to classification by the Finnish nurse; reactions 0–2 mm. were called negative, 4 or more mm positive.

Appendix table 5. *Correlation of reactions to Finnish Trambusti (Finnish reader) and Mantoux 10 TU (Danish reader) by size of induration among 699 vaccinated school children given both tests, Finland, November 1950*

Mantoux 10 TU (Danish reader) mm. induration	Finnish Trambusti (Finnish reader) mm. induration																			Total
	0	1	2	−3[1]	+	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
0	39	5	7	----	2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	53
1	3	----	2	1	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	7
2	7	1	8	----	----	----	1	----	----	----	----	----	----	----	----	----	----	----	----	17
3	5	----	5	----	3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	13
4	5	2	3	----	----	[2] 1	1	----	----	----	----	----	----	----	----	----	----	----	----	12
5	8	2	4	2	1	----	1	----	----	----	----	----	----	----	----	----	----	----	----	18
6	2	2	2	2	2	[2] 1	1	1	----	----	----	----	----	----	----	----	----	----	----	13
7	3	----	5	1	2	4	----	----	----	----	----	----	----	----	----	----	----	----	----	15
8	6	3	7	1	1	4	1	----	----	----	----	----	----	----	----	----	----	----	----	23
9	5	2	8	3	3	2	3	1	----	----	----	----	----	----	----	----	----	----	----	27
10	1	1	5	2	2	6	3	3	----	----	----	----	----	----	----	----	----	----	----	23
11	2	----	6	2	8	10	11	1	----	----	----	----	----	----	----	----	----	----	----	40
12	4	----	2	1	6	8	6	4	2	----	----	----	----	----	1	----	----	----	----	34
13	1	----	3	1	5	10	7	1	----	1	----	----	----	----	----	----	----	----	----	29
14	----	1	7	4	4	12	10	9	1	----	----	----	----	----	----	----	----	----	----	48
15	----	----	4	5	4	12	14	7	1	2	2	----	----	----	----	----	----	----	----	51
16	----	1	2	----	2	7	17	13	3	2	----	2	1	----	----	----	----	----	----	50
17	----	1	2	----	2	7	10	8	1	3	1	1	----	----	----	----	----	----	----	36
18	----	----	----	----	6	7	11	10	3	3	4	----	1	1	----	1	----	----	----	47
19	----	----	----	----	1	----	18	15	2	6	5	2	----	----	----	----	----	----	----	49
20	----	----	----	----	1	3	2	9	2	5	2	5	----	1	----	1	----	----	1	32
21	----	----	----	----	----	----	3	7	1	----	2	7	1	1	----	1	1	----	----	24
22	----	----	----	----	----	1	----	4	----	----	3	1	----	1	1	----	1	----	----	12
23	----	----	----	----	----	----	----	4	1	2	1	----	3	----	----	1	----	----	----	12
24	----	----	----	----	----	----	----	----	1	1	2	----	----	1	----	----	----	----	----	5
25	----	----	----	----	----	----	----	----	----	1	1	----	----	----	1	----	1	----	----	4
26	----	----	----	----	----	----	----	----	----	----	----	2	----	----	----	----	----	----	----	2
27	----	----	----	----	----	----	----	----	----	1	----	----	----	1	----	----	----	----	----	2
28	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	0
29	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	----	----	----	1
Total	91	21	82	25	56	95	120	97	18	27	23	20	6	6	3	5	3	0	1	699
				81																

[1] Indicated as positive or negative according to classification by the Finnish nurse; reactions 0–2 mm. were called negative, 4 or more mm. positive.
[2] Called negative by Finnish reader.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

Announcement

The new monthly PUBLIC HEALTH REPORTS (see back cover) will publish from time to time, as appropriate, reports, tabulations, and articles dealing with morbidity statistics, both domestic and foreign. The present weekly "Incidence of Disease" section, however, will be discontinued as of December 31, 1951.

Current provisional morbidity data on notifiable diseases for the United States will continue to appear in summary form and in tabulations by States and cities in the *Weekly Morbidity Report* issued by the National Office of Vital Statistics of the Public Health Service.

Libraries and agencies that have depended upon PUBLIC HEALTH REPORTS for current morbidity statistics for the United States may continue to receive the same data by writing to the National Office of Vital Statistics, Public Health Service, Washington 25, D. C., requesting that they be placed on the mailing list for the *Weekly Morbidity Report.* Individuals who wish to be placed on the mailing list should indicate how and to what extent they will make use of this publication.

Since the *Weekly Epidemiological Record* and other publications of the World Health Organization, Geneva, Switzerland, contain morbidity data for foreign countries, tabulations of notifiable diseases occurring outside the United States and its Territories will not appear regularly in National Office of Vital Statistics publications.

UNITED STATES

Reports from States for Week Ended November 17, 1951

Tularemia is a disease that has a very distinct seasonal distribution varying with the type of contact or means by which infection takes place. In areas where infection of humans is derived from contact with rabbits, a large proportion of cases occur in the hunting season—namely, in November, December, and January. In areas where ticks are the vectors of infection, tick-borne tularemia occurs most frequently in the months when adult forms of *Dermocenter andersoni* and *D. variabilis* are most numerous—i. e., in May, June, and July. In the Rocky Mountain area where the deer fly, *Chrysops discalis,* is found, nearly all cases which are associated with bites of this fly occur in June, July, and August.

In 1935 a total of 780 cases of tularemia was reported in the United States, following which there was an increase each year until 1939 when there were 2,291 cases. A period of decreasing incidence followed with a low point of 779 cases in 1944. Another peak was reached in 1947 when there were 1,401 cases. Since 1947 the number

of cases reported annually has been on the decline. The case fatality rate for the 1935–39 period was 7.8 percent, and for the 1945–49 period it was 6.0. However, for the latter period, the case fatality rates declined sharply from 13.5 in 1945 to 1.5 in 1949.

The case of anthrax reported by California was in a veterinarian who contracted the infection while performing an autopsy on a cow. The diagnosis was confirmed by culture and animal inoculation.

Fourteen cases of malaria in civilians were reported for the current week. Both cases reported in California were in persons having had military service. One had been in service in Korea. The other had had two recurrences of infection. The numbers of cases reported from military establishments have shown no appreciable decline in the past 8 weeks.

The number of cases of poliomyelitis for the current week was 573 as compared with 625 for the previous week. The cumulative total for the calendar year is 26,763 as compared with 30,756 for the same period last year. The cumulative total since the seasonal low week is 25,551 as compared with 29,625 for 1950.

Diphtheria showed an increase for the current week as compared with the previous week. Except for Missouri, the greatest concentration of cases was in the Southern States. The relatively large number of cases in Missouri is described below.

Measles incidence increased from 2,276 for the week ended November 10 to 3,083 for the current week. More than 40 percent of the cases for the current week were reported in the Middle Atlantic States.

Meningococcal meningitis cases (78) were greater in number for the previous week (59) and for the same week last year (59). California was the only State reporting more than 10 cases.

Epidemiological Reports

Salmonellosis

Dr. Dean Fisher, Maine Director of Health, has submitted supplementary information on a milk-borne outbreak of salmonellosis which was reported in September 1951. At that time there was epidemiological evidence that a nephew of a dairyman was the probable source of infection. The boy refused to submit specimens on religious grounds. However, a specimen was finally obtained which showed the presence of an organism with the characteristics of *S. paratyphi* B. Further confirmation of the boy's role in the outbreak is that eight of the cases and one healthy carrier all had the same phage type of organism as that obtained from the boy. This boy was found to be a convalescent carrier of *S. paratyphi* B. in 1948 and now is regarded as a chronic carrier.

Diphtheria

Dr. B. G. Hamilton, Missouri Director of Health, reports that 30 cases of diphtheria occurred in Kansas City for the 2 weeks ended November 17. All of the cases except 1 have been reported from a limited area of the city, and 12 live in a resident hotel.

Gastroenteritis

Dr. M. H. Merrill, California Acting Director of Health, has reported an outbreak of food poisoning in which Boston cream pie was suspected as being the vehicle of infection. About 256 persons ate the suspected food and it is estimated that 111 became ill. The food was prepared 10 hours before eating and left at room temperature until eaten.

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946-50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945-46 through 1949-50	Cumulative total for calendar year—		5-year median 1946-50
	Nov 17, 1951	Nov. 18, 1950			1950-51	1949-50		1951	1950	
Anthrax (062)	2	1	1	(1)	(1)	(1)	(1)	56	41	46
Diphtheria (055)	144	177	255	27th	[2] 1,619	2,180	3,865	[2] 3,627	5,308	8,476
Encephalitis, acute infectious (082)	16	29	13	(1)	(1)	(1)	(1)	932	886	589
Influenza (480-483)	566	756	940	30th	5,455	8,346	8,346	121,510	147,110	135,733
Measles (085)	3,083	1,863	1,696	35th	16,743	10,674	10,258	485,654	298,845	569,190
Meningitis, meningococcal (057.0)	79	55	64	37th	572	537	516	3,633	3,336	3,070
Pneumonia (490-493)	742	1,146	(3)	(1)	(1)	(1)	(1)	53,296	72,181	(3)
Poliomyelitis, acute (080)	573	958	651	11th	25,551	29,625	25,341	26,763	30,756	25,691
Rocky Mountain spotted fever (104)	3	3	2	(1)	(1)	(1)	(1)	326	449	544
Scarlet fever (050) [4]	1,189	1,097	1,504	32d	7,808	8,300	10,789	61,194	48,470	66,878
Smallpox (084)	-------	-------	-------	35th	3	3	4	14	29	51
Tularemia (059)	6	9	15	(1)	(1)	(1)	(1)	574	793	847
Typhoid and paratyphoid fever (040, 041) [5]	59	54	62	11th	2,401	2,645	3,074	2,836	3,154	3,559
Whooping cough (056)	1,151	2,052	2,052	39th	7,298	11,426	11,426	61,073	108,621	87,574

[1] Not computed [2] Addition: Minnesota, week ended Nov. 10, 3 cases. [3] Data not available.
[4] Including cases reported as streptococcal sore throat. [5] Including cases reported as salmonellosis.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Nov. 17, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**144**	**16**	**566**	**3,083**	**79**	**742**	**573**
New England	**2**	-	**7**	**489**	**8**	**38**	**6**
Maine	-	-	3	133	1	4	1
New Hampshire	-	-	4	25	1	-	-
Vermont	-	-	-	19	-	-	2
Massachusetts	2	-	-	181	4	-	1
Rhode Island	-	-	-	58	1	-	-
Connecticut	-	-	-	73	1	34	2
Middle Atlantic	**7**	**1**	**3**	**1,307**	**10**	**88**	**46**
New York	3	-	(1)	626	6	-	15
New Jersey	3	1	3	287	3	39	13
Pennsylvania	1	-	-	394	1	49	18
East North Central	**19**	**2**	**9**	**436**	**15**	**79**	**100**
Ohio	7	-	-	126	3	-	17
Indiana	5	-	5	20	1	9	11
Illinois	1	2	-	150	6	60	32
Michigan	6	-	4	97	4	10	18
Wisconsin	-	-	-	43	1	-	22
West North Central	**30**	**2**	**17**	**116**	**3**	**58**	**65**
Minnesota	2	-	-	16	-	2	6
Iowa	-	1	-	1	3	1	9
Missouri	27	-	-	6	-	-	18
North Dakota	-	1	16	78	-	51	2
South Dakota	-	-	-	4	-	-	2
Nebraska	1	-	-	6	-	-	10
Kansas	-	-	1	5	-	4	18
South Atlantic	**45**	**3**	**62**	**257**	**10**	**93**	**46**
Delaware	-	-	-	-	-	-	1
Maryland	-	2	1	146	1	32	5
District of Columbia	-	-	-	14	-	14	-
Virginia	13	1	-	24	5	40	4
West Virginia	-	-	-	13	2	-	16
North Carolina	9	-	-	7	1	-	1
South Carolina	9	-	5	5	-	2	3
Georgia	14	-	56	46	-	5	9
Florida	-	-	-	2	1	-	7
East South Central	**21**	**2**	**2**	**132**	**7**	**57**	**50**
Kentucky	4	-	-	79	1	3	4
Tennessee	2	1	-	10	2	-	16
Alabama	8	-	-	35	2	37	4
Mississippi	7	1	2	8	2	17	26
West South Central	**15**	-	**148**	**44**	**8**	**221**	**76**
Arkansas	2	-	111	4	1	21	7
Louisiana	3	-	2	-	-	26	6
Oklahoma	4	-	35	1	2	17	19
Texas	6	-	-	39	5	157	44
Mountain	**2**	**1**	**246**	**128**	**3**	**56**	**41**
Montana	1	-	2	45	-	-	3
Idaho	-	-	-	3	-	-	3
Wyoming	-	-	-	13	-	1	4
Colorado	-	-	116	19	1	17	8
New Mexico	1	1	-	3	-	11	3
Arizona	-	-	128	18	1	27	6
Utah	-	-	-	27	1	-	13
Nevada	-	-	-	-	-	-	1
Pacific	**3**	**5**	**72**	**174**	**15**	**52**	**143**
Washington	1	1	62	43	1	1	13
Oregon	-	-	6	30	2	19	14
California	2	4	4	101	12	32	116
Alaska	-	-	-	-	-	-	-
Hawaii	-	-	66	472	-	1	1

[1] New York City only.

Anthrax: California, Pennsylvania, 1 case each.

Reported Cases of Selected Communicable Diseases: United States, Week Ended November 17, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	3	11189	----	6	59	1,151	128
New England	----	66	----	----	3	136	----
Maine	----	12	----	----	----	8	----
New Hampshire	----	6	----	----	----	10	----
Vermont	----	1	----	----	1	30	----
Massachusetts	----	23	----	----	2	63	----
Rhode Island	----	7	----	----	----	2	----
Connecticut	----	17	----	----	----	23	----
Middle Atlantic	----	167	----	----	8	231	14
New York	----	92	----	----	2	94	6
New Jersey	----	29	----	----	2	71	----
Pennsylvania	----	46	----	----	4	66	8
East North Central	----	355	----	3	5	241	12
Ohio	----	136	----	----	1	60	2
Indiana	----	30	----	----	1	15	4
Illinois	----	56	----	3	----	25	5
Michigan	----	103	----	----	----	38	1
Wisconsin	----	30	----	----	3	103	----
West North Central	----	62	----	----	5	86	20
Minnesota	----	14	----	----	1	17	11
Iowa	----	13	----	----	----	1	6
Missouri	----	9	----	----	4	27	3
North Dakota	----	1	----	----	----	1	----
South Dakota	----	----	----	----	----	9	----
Nebraska	----	5	----	----	----	20	----
Kansas	----	20	----	----	----	11	----
South Atlantic	2	174	----	1	10	76	17
Delaware	----	2	----	----	----	----	----
Maryland	2	13	----	----	----	6	----
District of Columbia	----	10	----	----	----	2	----
Virginia	----	23	----	----	4	13	5
West Virginia	----	34	----	----	1	28	----
North Carolina	----	52	----	----	1	16	4
South Carolina	----	5	----	----	----	2	2
Georgia	----	16	----	1	2	4	6
Florida	----	9	----	----	2	5	----
East South Central	----	86	----	1	7	69	23
Kentucky	----	34	----	----	2	18	7
Tennessee	----	40	----	1	2	25	8
Alabama	----	9	----	----	1	18	2
Mississippi	----	3	----	----	2	8	6
West South Central	----	38	----	----	7	200	33
Arkansas	----	4	----	----	----	19	4
Louisiana	----	1	----	----	5	7	----
Oklahoma	----	12	----	----	----	19	4
Texas	----	21	----	----	2	155	25
Mountain	1	46	----	----	5	37	9
Montana	----	12	----	----	----	7	----
Idaho	----	10	----	----	----	----	----
Wyoming	1	----	----	----	----	2	9
Colorado	----	3	----	----	3	12	----
New Mexico	----	3	----	----	2	6	----
Arizona	----	6	----	----	----	9	----
Utah	----	11	----	----	----	1	----
Nevada	----	1	----	----	----	----	----
Pacific	----	195	----	1	9	75	----
Washington	----	14	----	----	1	2	----
Oregon	----	28	----	1	----	7	----
California	----	153	----	----	8	66	----
Alaska	----	----	----	----	----	----	----
Hawaii	----	----	----	----	----	----	----

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended November 3, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	5					4		1			
Chickenpox	876	2		6	1	149	244	38	115	174	147
Diphtheria	9					9					
Dysentery:											
Amebic	7					7					
Bacillary	20						1			2	17
Encephalitis, infectious	1							1			
German measles	52			2		3	7	1	8	21	10
Influenza	26			17				1			8
Measles	870	6		37	2	87	97	15	8	275	343
Meningitis, meningococcal	7			1	1	1	1	2			1
Mumps	313	5		7		48	141	18	16	24	54
Poliomyelitis	45			2	4	9	15	1	1	2	11
Scarlet fever	335	7		1	2	106	19	22	23	35	120
Tuberculosis (all forms)	184	38		4	1	74	19	22	13	13	
Typhoid and paratyphoid fever	5				1	3		1			
Venereal diseases:											
Gonorrhea	298	3		5	12	64	61	15	14	50	74
Syphilis	84	1		2	5	47	13	2	5	2	7
Primary	19					14	4			1	
Secondary	5					3	1	1			
Other	60	1		2	5	30	8	1	5	1	7
Whooping cough	266			1	3	97	63	17	26	37	22

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Smallpox

Burma. The outbreak of smallpox in Mergui continues with 22 cases being reported for the week ended November 10 as compared with 18 for the previous week. In Moulmein and Rangoon, one fatal case each was reported for the week ended November 10.

French Equatorial Africa. An outbreak of smallpox has occurred with 84 cases being reported for the period October 21–31, as compared with 16 for the previous 10-day period.

Indonesia. During the week ended October 27, two cases of smallpox were reported in Pontianak, Borneo.

Pakistan. For the week ended November 10, four imported cases of smallpox were reported in Karachi. These are the first cases since the week ended August 11, when one case was reported. During the week ended November 10, three cases were reported in Lahore.

Typhus Fever

France. During the week ended October 27, two cases of typhus fever were reported in the Seine Department. One case was a recurrence after 25 years, and the other was in a patient who became infected by handling contaminated packages. Neither of the patients had lice.

Indochina. For the week ended November 10, one case of typhus fever was reported in the seaport of Nhatrang, Viet Nam.

Turkey. During the week ended November 10, seven cases of typhus fever were reported in Turkey.

Yellow Fever

Colombia. During the week ended October 14, two cases of jungle yellow fever were reported in San Vicente de Chucuri, Santander Department.

Gold Coast. One suspected case of yellow fever was reported October 23, in a village 12 miles north of Oda.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work.

Requests for and communications regarding the PUBLIC HEALTH REPORTS and reprints should be addressed to the Surgeon General, Public Health Service, Washington 25, D. C. Subscribers should remit direct to the Superintendent of Documents, Washington 25, D. C.

Librarians and others should preserve their copies for binding, as the Public Health Service is unable to supply the general demand for bound copies. Indexes will be supplied upon request.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
Price 15 cents. Subscription price $4.75 a year. $6.25 foreign.

—Announcement—

PUBLIC HEALTH REPORTS

To be Published Monthly Next Year

Beginning in January 1952 PUBLIC HEALTH REPORTS will be published monthly. Two other technical publications of the Public Health Service—the Journal of Venereal Disease Information and the CDC Bulletin—are being merged with it.

The merger has come about as the result of an extended study of the Public Health Service's publishing activities. The new journal is designed to carry out more efficiently and economically the Public Health Service's responsibilities for disseminating scientific information on matters of health.

The new PUBLIC HEALTH REPORTS will be concerned with the technical and professional aspects of public health practice, with problems of health administration, and with research in these fields. It will include substantially the types of material that have been appearing in the three present journals and the monthly Tuberculosis Control Issue of PUBLIC HEALTH REPORTS. There will be more emphasis, however, on administrative practice, program development, and applied research aspects and less emphasis on bench research and clinical material not rather directly related to public health practice.

As has been true with each of the present journals, the pages of the new PUBLIC HEALTH REPORTS will be open, on merit, to any responsible author. General editorial guidance will be provided by a Board of Editors composed of individuals of recognized competence and professional stature drawn from both within and outside the Federal service.

Every effort will be made to furnish the new PUBLIC HEALTH REPORTS to representative organizations in public health and its related fields. Most of the readers on the mailing list are affiliated with organizations to which free distribution can legally be made. They will continue to receive the new journal either directly or through these organizations.

The first issue of the new PUBLIC HEALTH REPORTS and an application form for a free subscription will be sent to readers now on the free lists for technical periodicals. After they have had an opportunity to review the new PUBLIC HEALTH REPORTS and to consider its usefulness in their work, readers who wish to remain on the lists and receive the new periodical regularly should complete the application and send it in as soon as possible. This will allow time to revise the lists for mailing the second and subsequent issues.

The new PUBLIC HEALTH REPORTS will also be available by paid subscription from the Superintendent of Documents, Government Printing Office.

Public Health Reports

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[To be published monthly in 1952—see back cover]

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Division of Public Health Methods
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Public Health Reports

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Disabling Illness From Specific Causes Among Males and Females of Various Ages

Sample of White Families Canvassed at Monthly Intervals in the Eastern Health District of Baltimore, 1938–43

By Selwyn D. Collins, Ph.D., F. Ruth Phillips, and Dorothy S. Oliver*

Many field studies of illness in the general population have included little data on differentials between rates of males and females. This situation is largely due to the feeling that the data are biased because the informant is nearly always an adult female who, without any intention of misreporting, gives a more complete account of her own illnesses than of others in the household. However, absences because of sickness among employed females, as recorded by sick benefit associations and welfare departments of industrial establishments, indicate considerably more illness among women than men (*10, 10a, 11, 11a, 19*).

A few household surveys show that reported sickness declines as the time period covered by the survey increases (*2, 4*). In a study some years ago in Cattaraugus County, New York, it was impossible to make regular visits because of bad weather, bad roads, and shortage of personnel. As a result the data were tabulated to show the incidence of illness for the first month prior to the interview in comparison with the second, third, fourth, and fifth months prior to the interview. To correct for seasonal variation, the computations were made by quarter-years (annual basis) and the quarterly rates were averaged to get annual figures.

Figure 1 shows by month the recorded incidence for several months prior to the date of the interview with the household informant. In this chart the date of the interview is represented by "0" on the horizontal scale, and the rate for the first month prior to the interview

*From the Division of Public Health Methods, Public Health Service. The Milbank Memorial Fund, the Departments of Biostatistics and Epidemiology of the Johns Hopkins School of Hygiene and Public Health, and the Baltimore City Health Department cooperated in the study. Grateful acknowledgment is made to Jean Downes of the Milbank research staff who participated in all phases of the Baltimore Morbidity Survey.

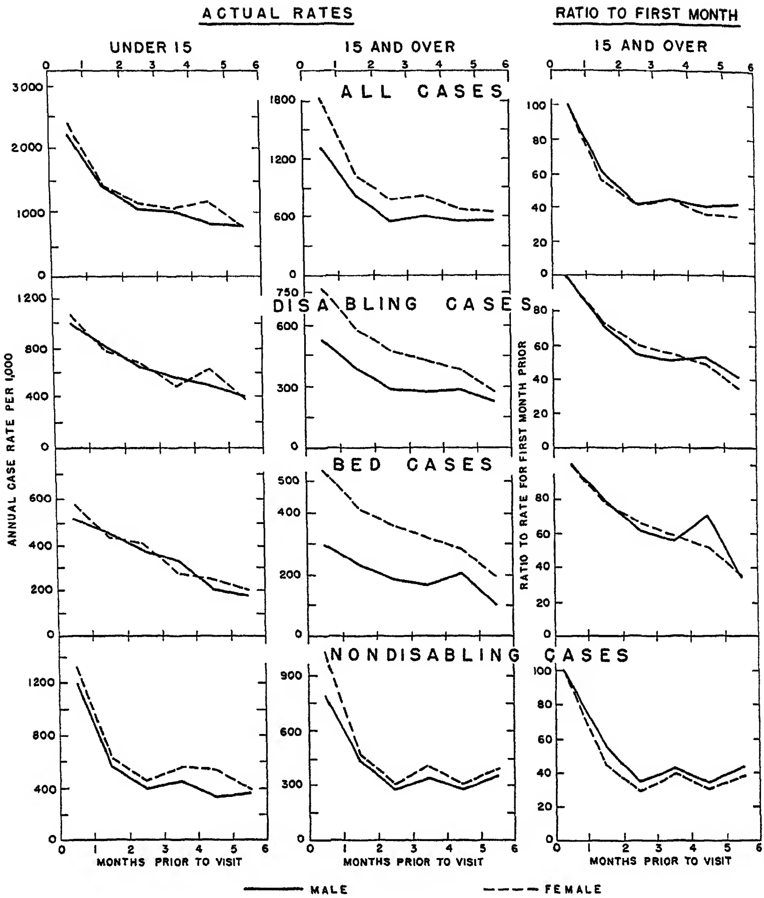

Figure 1. **Recorded case incidence from all causes among male and female children and adults in different months prior to the family interview; and for adult males and females the ratio (percent) of the incidence in the second and later months to that in the first month prior to the interview—house-to-house surveys of illness in Cattaraugus County, N. Y.**

NOTE: Rates are corrected for seasonal variation. On this chart zero on the horizontal scale represents the day of the interview, and the rate for the first month prior is plotted midway between 0 and 1 month: similarly, the second month prior is plotted midway between 1 and 2 months, etc.

is plotted halfway between "0" and "1," the rate for the second month prior to the interview between "1" and "2," etc. It is seen here that the recorded illness rates for both males and females of both age groups (under and over 15 years) decrease rather sharply as the time covered by the interview becomes more remote from the time of the interview.

Considering first the actual rates plotted in the two columns on the left of the chart, the differences between rates for males and females under 15 years of age are negligible as compared with the

large excesses in the rates for adult females over those of adult males. Nevertheless, when the rates for persons over 15 years are put on a percentage basis with 100 representing the rate for the month of the interview (right-hand column), there is no consistent difference between the sexes in the relative drop of recorded cases as the period covered becomes more remote from the interview.

This is equivalent to saying that the relative or percentage excess of the rate for females over that for males is as great in the month of the interview as at a time several months prior to the interview. The only exception is nondisabling sickness which is higher for females

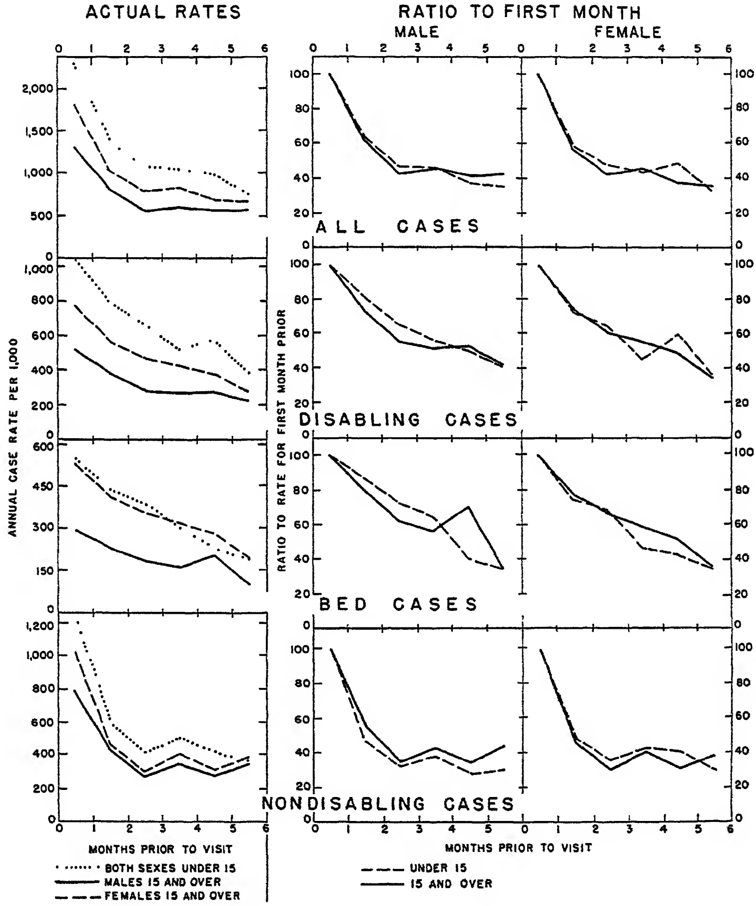

Figure 2. Recorded case incidence from all causes among male and female adults and among all children in different months prior to the family interview; and for children and adults of each sex, the ratio (percent) of the incidence in the second and later months to that in the first month prior to the interview—house-to-house surveys of illness in Cattaraugus County, N. Y. (For further details, see note to fig. 1.)

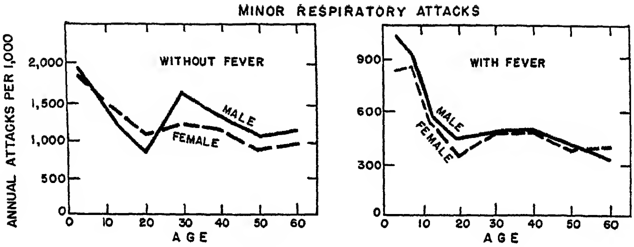

Figure 3. Incidence of minor respiratory attacks of two severity categories among males and females as reported semimonthly by the male household head—families of medical officers of the Army, Navy, Public Health Service, and the faculties of certain medical colleges.

of both the childhood and the adult age groups. This finding suggests that the higher rate for females is not entirely an artifact but is at least partially real. The possible forgetting of cases by the adult female informant is there, but it seems to be no greater for the male members of the household than it is for herself and other females. If the higher rate for females is entirely an artifact, it would seem to be due to lack of information about the illnesses of her husband and other adult males rather than a forgetting factor.

The discussion above refers to a direct comparison of rates of males and females within each of the two broad age groups. Figure 2 relates to the same matter, but the direct comparison is between rates in the two broad age groups within each sex group. From the actual rates on the left of figure 2, it is seen that children under age 15 have consistently more illness than adults in the various months prior to the interview, except for cases confined to bed. However, when these rates for males and females are put on a percentage basis with the rate for the first month prior to the interview as the base (100 percent), there is little consistent relative difference between recorded rates for girls and for adult females, except for nondisabling cases. Among males of the two age groups, disabling and bed cases for boys seem to fall less rapidly as the time covered becomes more remote from the interview, at least up to the fourth month prior to the interview. As might be expected, the recorded nondisabling cases fall off more rapidly than the more severe cases as the time interval covered becomes more remote from the date of the interview.

Figure 3 represents age incidence by sex of minor respiratory attacks among the families of medical officers of the United States Army, Navy, and Public Health Service and families of teachers in medical schools (*17*). A questionnaire about minor respiratory attacks in the family was sent to the medical officers and teachers at semimonthly intervals, so the man of the household became the reporter for the family. Most of the household heads in this type of family would be 25 years old and over. In the minor cases without fever,

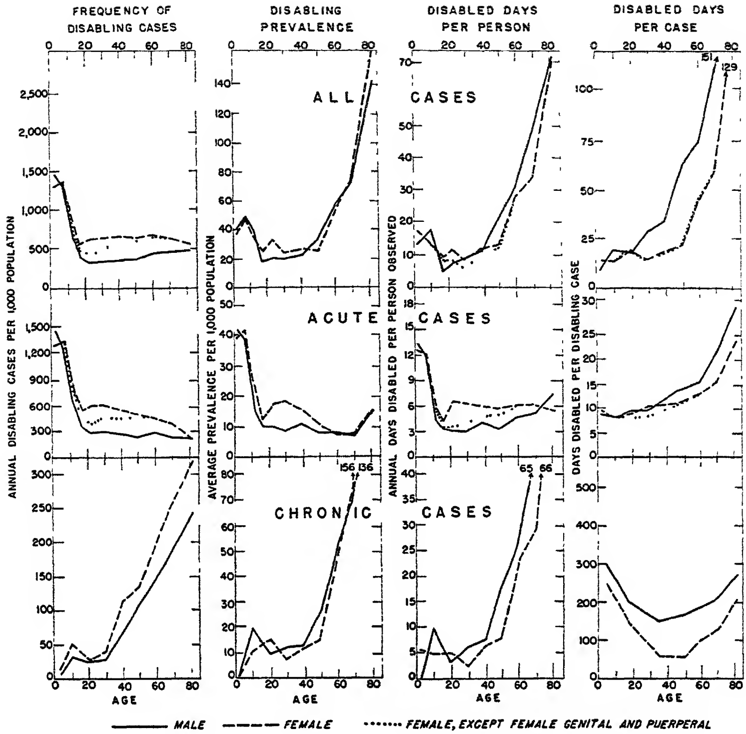

Figure 4. Annual frequency, annual days of disability, and average prevalence of disabling illness from all causes, acute disease, and chronic disease among white males and females of specific ages—Baltimore Eastern Health District sample, 1938–43.

NOTE: Scales are so arranged that each rate for all ages of both sexes plots on the vertical rate scale at a distance equal to 30 years on the horizontal age scale.

the reports were definitely higher for males of the ages over 25 years in contrast to the younger ages. However, for the more severe attacks which were accompanied by fever, rates for the two sexes were approximately the same.

In view of the fact that in the Baltimore study visits to the households were made at monthly intervals, there would be less forgetting than in studies in which the interviewer visited the family at less frequent intervals.

Consideration of the differences between males and females in extent of illness led to an analysis of what diseases and at what ages the largest differences are experienced. Numerous papers have discussed and presented data on sex differences in the extent of illness and mortality among humans (*1*, *3*, *7*, *9*, *12*, *14*), and at least one contains an excellent summary of fetal and neonatal mortality among various species of animals (*1*).

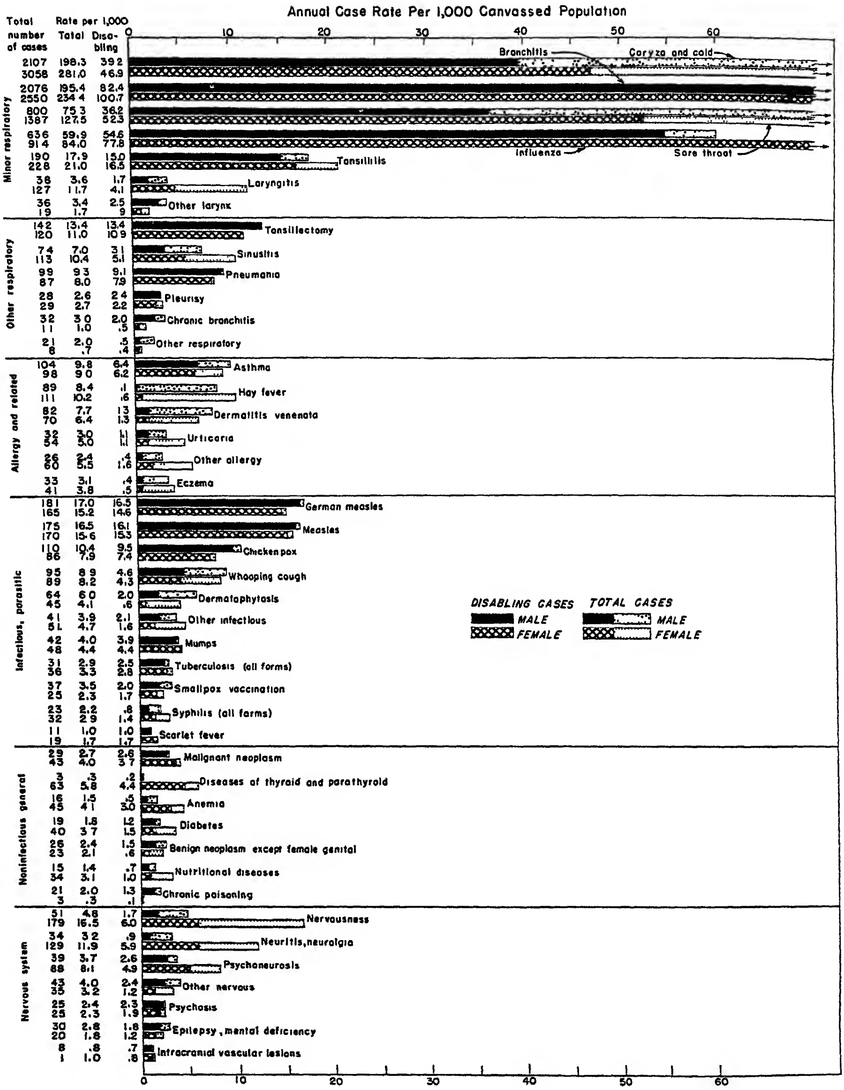

Figure 5. Annual total and disabling frequency of illness from specific causes among white males and females of all ages—Baltimore Eastern Health District sample, 1938–43.

The present study is confined largely to cases which disabled the patient for 1 day or longer, in the sense of causing inability to do work away from home or usual household duties at home, to attend school, or to carry on other usual activities. Of all of the disabling illnesses, 91 percent confined the patients to the house for 1 day or longer, and 56 percent confined them to bed for 1 day or longer. De-

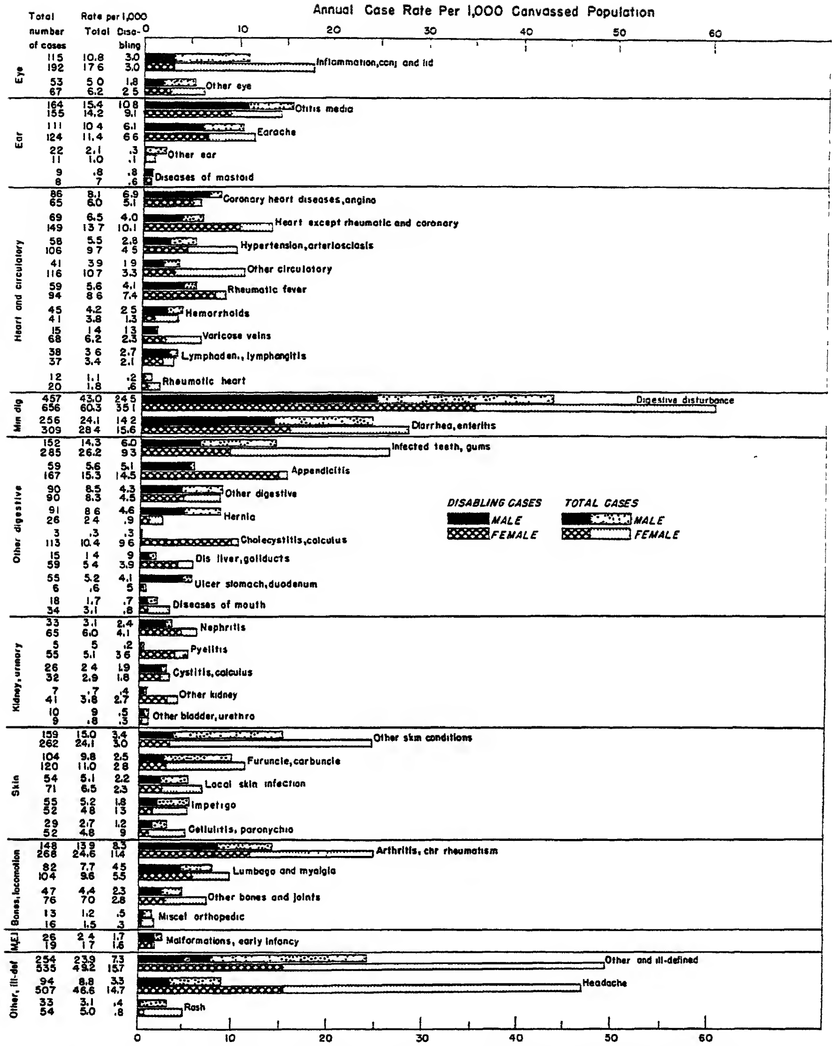

Figure 6. Annual total and disabling frequency of illness from specific causes among white males and females of all ages—Baltimore Eastern Health District sample, 1938–43.

tails as to what constituted disability and just how the cases were classified are discussed in preceding papers (*4*, *5*).

Selection and Characteristics of the Sample Population

The method of selecting the sample population to be studied has been described elsewhere (*8*), and considerable data comparing the characteristics of this sample with other population groups are shown in another publication (*4*). The canvassed families all lived in the

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original Eastern Health District of Baltimore, wards 6 and 7 (*6*, *13*, *15*, *16*), adjacent to the Johns Hopkins School of Hygiene and Public Health and the Johns Hopkins Medical School and Hospital. From prior censuses conducted by the School of Hygiene and the U. S. Public Health Service, data were available on the number of houses in each square block (*18*). For the present study, monthly canvasses were made of entire city blocks running in approximately parallel diagonal directions throughout the two wards.

In the 35 blocks selected for canvassing, every household was covered except a negligible number which refused cooperation. It was not practicable to follow the original family when it moved out of the study blocks; therefore, the family moving into the house was added to the study. Of the 35 blocks, 17 were retained throughout the 5-year study; 17 of the other blocks were dropped at the end of the third year, and one was dropped within the first 2 months of the third year.

In the entire group of canvassed families in the sample (whole blocks canvassed without exception), 21,505 full-time person-years of life were observed during the 5-year period. The study years included the 12 months ending with May. The numbers of full-time person-years of life observed for each year were: 1938–39, 5,655; 1939–40, 5,547; 1940–41, 5,110; 1941–42, 2,682; and 1942–43, 2,511. The total number of different individuals observed 2 consecutive months or longer at any time during the 5 years was 9,917 (5,638 in blocks canvassed for 5 years and 4,279 in blocks canvassed for the first 3 years only).

Method of Collecting and Tabulating the Data

Trained interviewers visited all of the households at intervals of approximately 1 month, inquiring at each visit about any illness in the family since the preceding visit. The illnesses under study included all diagnoses of all severities, that is, disabling in the sense of causing the patient to lose 1 or more days from usual activities, and nondisabling which caused no loss of time from such activities. Thus, disabling illness is interpreted as a severity category rather than as illness affecting only employed workers.

The variety of diagnoses reported, the degree of severity of the cases of each disease, and age-specific case rates, including all illness (disabling and nondisabling), are presented in preceding papers (*4*, *5*). Rates of disabling illness are used in this study because they should be better remembered and thus more comparable as between the sexes.

Tabulations of data on chronic diseases can be made in several ways. One useful way is to count the persons with specific chronic diseases and to count for each the number of days of disability during some

specified period such as 2, 3, or 5 years. Such a count would give the load of chronic disease in terms of cases on hand or under treatment and the load in terms of days of disability, in the sense of inability to be about one's usual activities. Even better than this, in a large study, would be to record the number of new cases of chronic disease of each important diagnosis with the original date of onset within the study period. These data in terms of total cases or of cases that disabled the patient would give the increment or incidence of chronic disease within a given period. In a survey of a small population the numbers of new cases of chronic disease are small as compared with the total case load for disability or for medical care during the study period. This is particularly true for chronic diseases of fairly specific diagnoses.

To compare the case load of chronic disabling diseases with that of acute disabling diseases, it would seem feasible to use attacks or episodes of chronic diseases that caused the patient to be unable to be about his usual duties during some part of the study period. In this study this method was used for cases together with disabled days for acute and chronic diseases per person (well or sick) under observation. Chronic diseases were identified primarily by medical diagnosis and by the patient's history prior to and during the study. Diagnoses which might be either acute or chronic were classified as chronic unless later inquiry revealed no further illness or symptoms and there was no prior history of the disease. In this study chronic disease is considered as a single category. It includes temporary chronic illness and what has been called permanent chronic illness (disability during the entire study period).

However, one of the difficulties of dealing with chronic attacks or episodes in a 3- to 5-year study is that some individuals may report an excessive number of attacks. In this study a few individuals reported 30 or more disabling attacks or episodes of the same disease. The temporary chronic disabling cases had an average duration of 43 days of disability, with 724 days for permanent chronic cases, as compared with 10 days of disability per disabling case of acute disease.[1]

The effect of including patients with exceptionally large numbers of chronic disabling attacks of the same disease in the computation of age curves of disabling attacks or episodes is to make these curves of chronic diseases unreliable, except with an unusually large body of data. The rates for some of the diseases included in the tables and charts in this study are shown only in broad age groups; this procedure was followed to avoid distortion of the age curves because of the inclusion of a few individuals with an excessive number of episodes of the same disease.

[1] Further tabulations are in progress which will consider the illnesses of persons under observation for specified periods such as 2, 3, or 5 years.

Table 1. *Illness rates*[1] *of various kinds from all causes among white males and females of specific ages canvassed at monthly intervals in a sample of the Eastern Health District of Baltimore, 1938–43*

[Disabling cases; sole and primary causes only]

Type of case	All ages: Number of cases or days	All ages: Rate	Age: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65–74	75 and over
		Annual frequency of disabling cases per 1,000 males and females [2]											
All:													
Male	5,792	545	1,447	1,272	687	380	320	333	350	358	439	455	480
Female	8,195	753	1,306	1,349	884	569	625	648	656	637	691	632	555
Female, except genital and puerperal	7,410	681	1,304	1,348	853	486	440	498	580	591	670	632	550
Acute:													
Male	5,152	485	1,442	1,238	659	355	298	306	281	248	296	240	235
Female	7,211	663	1,296	1,325	806	547	597	609	541	501	458	403	232
Female, except genital and puerperal	6,474	595	1,294	1,323	775	464	412	462	470	466	457	403	227
Chronic:													
Male	640	60	5	31		23		27	69	110	168		245
Female	984	90	10	53		25		40	116	136	232		322
		Average prevalence of disabling cases per 1,000 males and females [2]											
All:													
Male	4,467	35	43	51	40	19	21	21	24	34	60	78	151
Female	4,981	38	39	49	36	26	35	25	27	26	56	80	171
Acute:													
Male	1,839	14.4	41.6	37.7	15.4	10.1	10 1	8.7	10 6	7.8	7.8	7 2	15.2
Female	2,373	18.2	38.5	41.2	21.8	12.9	17.0	18.2	15.5	10.9	7.7	7.1	15 4
Chronic:													
Male	2,628	20 6	1 5	19.5		9 7		12 2	13 3	26.5	52 5	70.5	135.6
Female	2,608	20.0	.6	11.4		15 4		7 3	11 9	15.4	48 5	72 9	156.0

		Annual days of disability per male and female observed [2]											
All.													
Male	170,695	16.1	13.3	18.4		4.9	7.1	9.2	11.3	21.2	30.9	49.1	72.3
Female	170,828	15.7	17.7	13.9		9.6	11.7	8.8	12.2	13.0	29.1	34.9	71.8
Female, except genital and puerperal	158,500	14.6	17.7	13.9		8.9	8.6	6.3	10.7	12.1	28.9	34.9	71.7
Acute:													
Male	53,593	5.0	13.2	11.8	4.4	3.2	3.1	3.0	4.0	3.2	4.6	5.1	7.2
Female	73,617	6.8	12.4	12.1	6.1	4.1	6.7	6.3	5.9	5.7	6.0	6.1	5.5
Female, except genital and puerperal	62,175	5.7	12.4	12.1	5.9	3.4	3.6	3.9	4.8	4.9	6.0	6.1	5.4
Chronic:													
Male	117,102	11.0	.1	10.4		2.8		6.2	7.4	18.0	26.3	44.1	65.0
Female	97,211	8.9	5.3	5.1		5.3		2.5	6.3	7.3	23.1	28.8	66.3
		Days of disability per disabling case for males and females											
All:													
Male	5,792	29	9	19		17		28	32	59	70	108	151
Female	8,195	21	14	13		18		14	19	20	42	55	129
Female, except genital and puerperal	7,410	21	14	13		19		13	18	21	43	55	130
Acute:													
Male	5,152	10.4	9.1	8.5		9.6		9.9	13.6		15.5	21.1	30.8
Female	7,211	10.2	9.6	8.4		9.4		10.4	11.2		13.1	15.1	23.7
Female, except genital and puerperal	6,474	9.6	9.6	8.5		8.0		8.5	10.3		13.0	15.1	23.6
Chronic:													
Male	640	183	[3] 291		[4] 196			147		164	185	205	266
Female	984	99	245		141			57		54	99	126	206

[1] Cases in this table represent disabling attacks or episodes of acute and of chronic diseases. Thus, acute and chronic cases are on the same basis and the same individual may have had more than one attack or episode of the same acute or chronic disease within a given study period. All tabulations for all causes count cases and days of disability only once, regardless of the number of diagnoses required to describe the diseases.

See text for method of identifying chronic diseases.

For all causes combined the great majority of the disabling cases are acute with onset within the patient's period of observation. Thus, the combined age curve for cases of all causes resembles the frequency of acute disabling cases more closely than the age curve of disabling prevalence.

Days of disability per person observed is a count of the days within the study period only, without respect to dates of onset or termination of the disability. Thus, this day rate for chronic diseases is the same whether it is counted as the total days of disability suffered during a given time by an individual with a chronic disease or whether it refers to the disability summated from the disabling attacks or episodes.

[2] Rates, except prevalence, are based on full-time years of life observed (see table 2); prevalence rates are weighted averages of prevalence for the 60 months of the survey, the weights being proportional to the number of individuals covered by the interviews during the month. That is, the population used was the total individuals covered by the interviews, and the cases were the total persons who were reported as disabled at the time of the interview. The interviews (populations) for computing prevalence rates were: All ages: males 127,492, females 130,575; under 5: males 9,721, females 9,424; 5–9: males 10,196, females 8,830; 10–14: males 10,424, females 10,530; 15–19: males 12,499, females 12,141; 20–24: males 11,068, females 11,978; 25–34: males 22,604, females 22,559; 35–44: males 18,561, females 19,510; 45–54: males 16,741, females 16,148; 55–64: males 9,276, females 10,692; 65–74: males 5,148, females 6,187; 75 and over: males 1,180, females 2,532.

[3] Data for under 10 years.

[4] Data for 10–24 years.

Disabling Illness from All Causes Among Males and Females of Specific Ages

Before considering illness from the several causes, it may be profitable to summarize disabling illness in males and females of specific ages as measured by different types of rates. Figure 4 presents such a summary, including for each type of case the rate for all causes for males and females, respectively, and, where available, a second rate for females exclusive of female genital and puerperal conditions. It was found that among males illness relating to the genital organs was negligible; thus no second line appears on the chart for these conditions.

As in the preceding study of illness for both sexes combined (*5*), four types of illness rates from all causes are shown—annual frequency of disabling cases, average prevalence of disabling sickness as of the day of the interview (average over the 60 months covered), annual days of disability per person (sick or well) observed, and days of disability per disabling case. Each of these measures is shown by sex and age and separately for acute and chronic conditions in figure 4 and table 1.

In terms of the average prevalence of disabling illness at the time of the interview, there is little consistent difference between the sexes in the rates for all types of cases combined (35 and 38 per 1,000 males and females, respectively, of all ages) or for chronic cases only (21 and 20 per 1,000 males and females of all ages). For the annual days of disability per person observed, the total rates (16.1 and 15.7 days per male and female of all ages) and the chronic rates (11.0 and 8.9 days per male and female of all ages) both indicate little difference between the sexes. Although the actual difference is small for all ages combined, there is an excess in total cases for males after 45 years of age. The similarity in the age curves for the rates of prevalence and days lost per person observed would be expected, inasmuch as both types of rates are measures of days lost. In contrast, the case frequency per 1,000 persons for both total (545 and 753 per 1,000 males and females, respectively, of all ages) and chronic conditions (60 and 90 per 1,000 males and females of all ages) are considerably and rather consistently higher for females than males. The result of these various differences is that days of disability per disabling case for both total (29 and 21 per case for males and females of all ages) and chronic conditions (183 and 99 per case for males and females of all ages) are definitely and rather consistently higher for males than females.

The results discussed in the several preceding paragraphs could come from an understatement of the chronic diseases present among males, since the informant was usually an adult female who would know her own illness history better than that of other members of the

household. However, it could be the result of the not uncommon practice of employed men obtaining diagnosis and medical care for their illnesses only after their health has been considerably impaired, with more time lost per case than among those who seek diagnosis and treatment before their illnesses have progressed to serious stages.

The prevalence data refer to the day of the interview and should be more accurate than data involving memory over even as short a period as one month. The fact that the prevalences of illness are not very different for men and women is significant in view of the greater accuracy of that type of rate. However, prevalence is greatly influenced by the durations of illnesses, and is a measurement of rather different factors than appear in a count of case frequency over a period of time.

Illness From Specific Diseases Among Males and Females of All Ages

Figures 5 and 6 afford a comparison of case rates for specific diagnoses for males and females of all ages. The darker part of the bars indicates the disabling case rate, and the total length of the bar represents the rate for all cases, both disabling and nondisabling.

As a first approximation in evaluating sex differences in illness rates it may be worthwhile to consider the data in figures 5 and 6 in terms of the number of disagnoses with higher rates for females than males, each diagnosis being counted regardless of whether it represents an important or a trivial disease. Confining the consideration to diseases only, and further to diseases common to both sexes, 87 different diagnoses are shown in the bar charts. These 87 diagnoses are classified below into three categories for each sex:

	Number diagnoses	
Case rates for females higher than for males for both disabling and total cases	49	
Case rates for females the same as for males for disabling cases but higher for the total cases	2	
Case rates for females higher than for males for disabling cases but lower for the total cases	1	
Total with case rates higher for females than males	52	(60%)
Case rates for males higher than for females for both disabling and total cases	28	
Case rates for males the same as for females for disabling cases but higher for total cases	1	
Case rates for males higher than for females for disabling cases but lower for total cases	6	
Total with case rates higher for males than females	35	(40%)
Total diagnoses common to the two sexes	87	(100%)

Breaking down the above data into total and disabling cases, 57 (66 percent) of the 87 tabulated diagnoses common to both sexes had higher total rates for females, and 50 (60 percent) of the 84 diagnoses had higher disabling rates for females, the other 3 being the same for males and females.

Of the 57 diagnoses with higher total rates for females, 32 (56 percent) had rates for females that were 50 percent or more above those for males and 19 (33 percent) had rates that were 2 or more times those for males. Of the 50 diagnoses with higher disabling rates for females, 27 (54 percent) had disabling rates that were 50 percent or more above those for males and 17 (34 percent) had rates that were 2 or more times those for males.

Males had higher total rates than females in 30 (34 percent) of the 87 diagnoses, and higher disabling rates in 34 (40 percent) of the 84 diagnoses, the other 3 being the same for males and females. Of the 34 diagnoses with higher disabling rates for males, 13 (38 percent) had rates that were 50 percent or more above those for females, and 9 (26 percent) had rates that were 2 or more times those for females.

Although it was necessary to cut off the bars for the minor respiratory diseases, it is evident that they show the largest rates in terms of cases. In terms of total as well as disabling cases, a high proportion of these diagnoses show higher rates for females than for males of all ages. Large percentage differences occur for laryngitis, and, even if other diseases of the larynx are added to laryngitis, the percentage excess for females over males is considerably more than the average. There are no outstanding excesses for either sex in the rates at all ages from the acute infectious diseases. Although the numbers of disabling cases are small, several noninfectious general diseases have much higher disabling rates for females than males; among these are diseases of the thyroid and parathyroid glands, cholecystitis, diseases of the liver and gall ducts, nervousness, neuritis and neuralgia, headache, and heart disease except coronary and rheumatic. In all of these diagnoses, the rates for women are two or more times the rates for men. There are similarly outstanding differences in a few diseases that have higher disabling rates for males; among these are ulcer of the stomach and duodenum, chronic bronchitis, dermatophytosis, benign tumors except of the female genital organs, hernia, and most types of accidents, although the latter are not included in this paper.

Age and Sex Variation in Disabling Illness From Specific Diseases

Figures 7, 8, and 9, and table 2 show disabling case rates for certain diagnoses for males and females of specific ages. For the most part these diagnoses have a sufficiently large number of disabling cases to give relatively stable rates. However, where the differences in the

Table 2. *Annual disabling[1] case rates per 1,000 population from specific causes among white males and females of various ages canvassed at monthly intervals in a sample of the Eastern Health District of Baltimore, 1938–43*

[Sole, primary, and contributory causes]

Diagnoses with code numbers[2]	All ages: Number of cases	All ages: Rate[3]	Age: Under 5	Age: 5–14	Age: 15–24	Age: 25–44	Age: 45–64	Age: 65 and over
Influenza and grippe (430):								
Male	580	54.59	66.67	62.25	50.43	54.50	51 66	39.85
Female	846	77 75	81 53	78.12	62.19	90.99	72.87	67 40
Bronchitis (471, 479):								
Male	896	84 34	227.16	165.21	50 43	49 55	62.73	43 64
Female	1,101	101.19	276 43	165.53	63.68	77 87	75.10	66.02
Coryza and cold (440):								
Male	416	39.16	175 31	67.48	27 00	18.36	15.68	13.28
Female	510	46.87	165.61	90 51	33 83	30 23	24.14	8.25
Tonsillitis and sore throat (460, 461, 466):								
Male	544	51.20	192 59	113.44	37.19	27.11	11.53	3.80
Female	748	68.74	169.43	146.31	56.22	47.63	39.34	15.13
Laryngitis (467):								
Male	18	1.69	3.70	1.16	1.02	2 33	.92	1.90
Female	45	4.14	5 10	3.72	2.99	5.99	3.58	--------
Pneumonia (481–489):								
Male	97	9.13	37.04	13.96	3.57	4.95	6.00	11.39
Female	86	7 90	28.03	9 30	4.48	5.42	5.36	12 38
Tonsillectomy (450):								
Male	142	13.37	33 33	45.96	9 17	4.95	.46	--------
Female	119	10.94	21.66	38.44	9.45	5.70	.45	--------
Asthma (501):								
Male	68	6.40	17.28	17.45	1 53	3.79	3.23	1 90
Female	68	6.25	2.55	7 44	9.95	4.85	5.81	5 50
Benign and malignant neoplasms (100–199, 657, 667):								
Male	44	4.14	--------	--------	3.57	1.46	11.07	15.18
Female	91	8.36	6.37	--------	2.99	9.70	12.52	24.76
Diabetes (210–219):[4]								
Male	13	1.22	--------	--------	--------	[4].65	[4] 4.30	[4] 4.48
Female	16	1.47	--------	--------	--------	.62	1.49	8 44
Diseases of thyroid and parathyroid glands (220–232):								
Male	2	.19	--------	--------	--------	.58	--------	--------
Female	48	4.41	--------	1.24	1.00	8.27	6.71	--------
Neuritis and neuralgia (316, 337, 784)								
Male	10	.94	--------	1.16	--------	.87	2 31	--------
Female	64	5 88	--------	.62	6.47	6.27	10.28	6.88
Psychoneurosis and nervousness (330, 786):								
Male	46	4 33	--------	1 16	2.55	3.50	10.61	7.59
Female	118	10 84	--------	1.24	8 96	14.26	21.01	1 38
Inflammation of conjunctiva and eyelid (347):								
Male	32	3 01	11.11	9.31	1.02	--------	.82	--------
Female	33	3 03	8 92	9 92	1.49	--------	1.08	--------
Earache (351):[5]								
Male	65	6 12	34.57	14.54	3.06	.87	.92	1.90
Female	72	6.62	31.85	16.74	2.49	3.14	1.34	1.38
Otitis media (350):[5]								
Male	115	10.82	81.48	33.74	2.55	2.91	.92	--------
Female	99	9 10	57.32	19.84	3.98	4.56	1.34	1.38
Rheumatic fever, rheumatic heart (200–204, 360, 365):[4][5]								
Male	46	4.33	--------	16.87	[4] 1.82	[4] 1.36	[4] 4.62	
Female	86	7 90	2 55	17.36	6.68	9.08	1.85	
Coronary heart disease and angina (382):								
Male	73	6.87	--------	--------	--------	1.75	16.14	60.72
Female	55	5.05	--------	--------	--------	.29	9.39	45.39
Heart except rheumatic and coronary (370, 380, 381, 388, 389):								
Male	43	4.05	--------	--------	.51	2.33	9.23	24.67
Female	110	10.11	--------	.62	1.00	3.99	28.16	41.27
Hypertension, arteriosclerosis (290–295, 307, 390, 399, 400):								
Male	37	3.48	--------	1.75	--------	1.46	8.76	18.98
Female	58	5.33	--------	3.72	--------	1.71	10.73	30.26
Varicose veins (410–414):								
Male	14	1.32	--------	--------	.51	.58	2.77	9.49
Female	25	2.30	--------	--------	--------	.86	6.26	11.00

See footnotes at end of table.

Table 2. *Annual disabling*[1] *case rates per 1,000 population from specific causes among white males and females of various ages canvassed at monthly intervals in a sample of the Eastern Health District of Baltimore, 1938–43*—Continued

[Sole, primary, and contributory causes]

Diagnoses with code numbers [2]	All ages: Number of cases	All ages: Rate [3]	Age: Under 5	Age: 5–14	Age: 15–24	Age: 25–44	Age: 45–64	Age: 65 and over
Hemorrhoids (415):								
Male	27	2.54	--------	--------	0.51	4.37	4.15	3.80
Female	14	1.29	--------	--------	.50	2.57	1.79	--------
Digestive disturbance (560–570).								
Male	260	24.47	71.60	70.39	11.21	9.62	9.23	11.39
Female	382	35.11	77.71	73.16	21.89	19.40	28.61	37.14
Diarrhea and enteritis (009, 530–539):								
Male	151	14.21	87.65	19.20	6.11	5.54	6.00	5.69
Female	170	15.62	62.42	17.36	7.96	13.12	9.83	12.38
Infected teeth and gums (510):								
Male	64	6.02	2.47	10.47	10.19	5.54	2.31	--------
Female	101	9.28	--------	22.94	14.43	7.13	4.47	--------
Ulcer of stomach and duodenum (520–527):								
Male	44	4.14	--------	--------	1.02	8.16	6.46	--------
Female	5	.46	--------	--------	--------	.86	.89	--------
Appendicitis (540–549):								
Male	54	5.08	1.23	6.40	10.19	4.66	2.77	--------
Female	158	14.52	--------	17.98	28.86	15.69	7.15	--------
Hernia (550–559):								
Male	49	4.61	2.37		2.55	6.41	6.00	5.69
Female	10	.92	1.25		.50	.86	.89	1.38
Diseases of gallbladder, gall ducts, and liver (580–589):								
Male	13	1.22	--------	.58	.51	.87	3.23	1.90
Female	146	13.42	2.55	1.86	2.49	21.68	23.69	9.63
Nephritis (375, 600–607):								
Male	26	2.45	--------	--------	.51	.58	6.92	15.18
Female	45	4.14	--------	--------	.50	2.57	9.39	19.26
Pyelitis (610): [4]								
Male	2	.19	--------			--------	.92	--------
Female	39	3.58	[4] 5.92	[4] 3.81		2.85	3.58	1.38
Arthritis and chronic rheumatism (720–729, 783):								
Male	88	8.28	--------	1.16	1.02	7.87	18.91	30.36
Female	124	11.40	--------	3.72	1.49	5.99	25.93	49.52
Lumbago and myalgia (740, 782):								
Male	48	4.52	1.23	2.33	4.08	5.25	6.92	3.80
Female	60	5.51	1.27	3.10	2.49	6.27	9.39	8.25
Headache (785):								
Male	35	3.29	--------	7.56	6.62	2.33	.37	
Female	160	14.70	1.27	11.16	7.46	18.54	20.58	
Population (years of life):								
Male	10,624		810	1,719	1,963	3,431	2,168	527
Female	10,881		785	1,613	2,010	3,506	2,237	727

[1] Disabling cases refer to those that caused the patient to lose 1 or more days from work, school, housework, or other usual activities. In this table each diagnosis includes all disabling cases of the given disease whether it was the sole, primary, or contributory cause of the illness. Thus, the sum of all cases in this table may add to more than the total in table 1 which includes only sole or primary causes. For chronic diseases each disabling attack or episode (continuous period of disability) is counted as a separate case. All ages includes a few of unknown age.

[2] Diagnosis code numbers as given in A Manual for Coding Causes of Illness, Public Health Service Miscellaneous Publication No. 32, G. P. O., Washington, 1944. This table includes selected specific causes rather than every cause that appeared in table 6 of reference (*4*) and table 2 of reference (*5*). Some diagnoses with insufficient disabling cases for age curves for each sex are omitted but some are combined with other similar diagnoses. See notes to table 1 and text for further details.

[3] Rates per 1,000 in this table are computed with 2 decimals for convenience in making further computations based on the rates even when the last digit is not significant. The total number of cases for each diagnosis is given in the first column and the populations for each age are at the bottom of the table in terms of full-time person-years of life.

[4] Rates in table that are not for standard ages in column headings: Diabetes, ages are 35–44, 45–54, 55+; rheumatic fever, ages are 15–34, 35–54, 55+; pyelitis, ages are under 10, 10–24.

[5] Rates in table are for 5–14 but those plotted are: Earache, ages 5–9, M. 21.18, F. 27.17; ages 10–14, M. 8.06, F. 7.98. Otitis media, 5–9, M. 31.76, F. 29.87; 10–14, M. 5.75, F. 4.56. Rheumatic fever, 5–9, M. 14.12, F. 13.59; 10–14, M. 19.56, F. 20.52

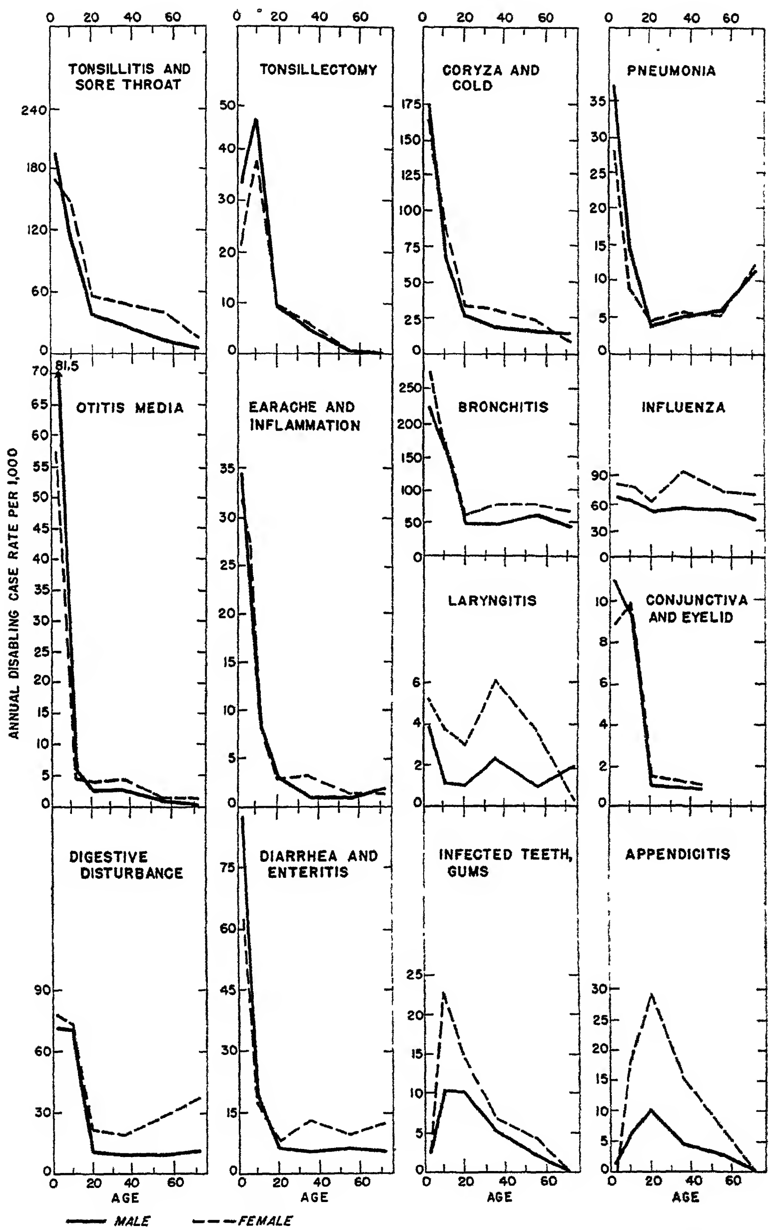

Figure 7. Annual disabling case frequency from specific causes per 1,000 population among white males and females of various ages—Baltimore Eastern Health District sample, 1938–43.

NOTE: Scales so arranged that each rate for all ages of both sexes plots on the vertical rate scale at a distance equal to 30 years on the horizontal age scale.

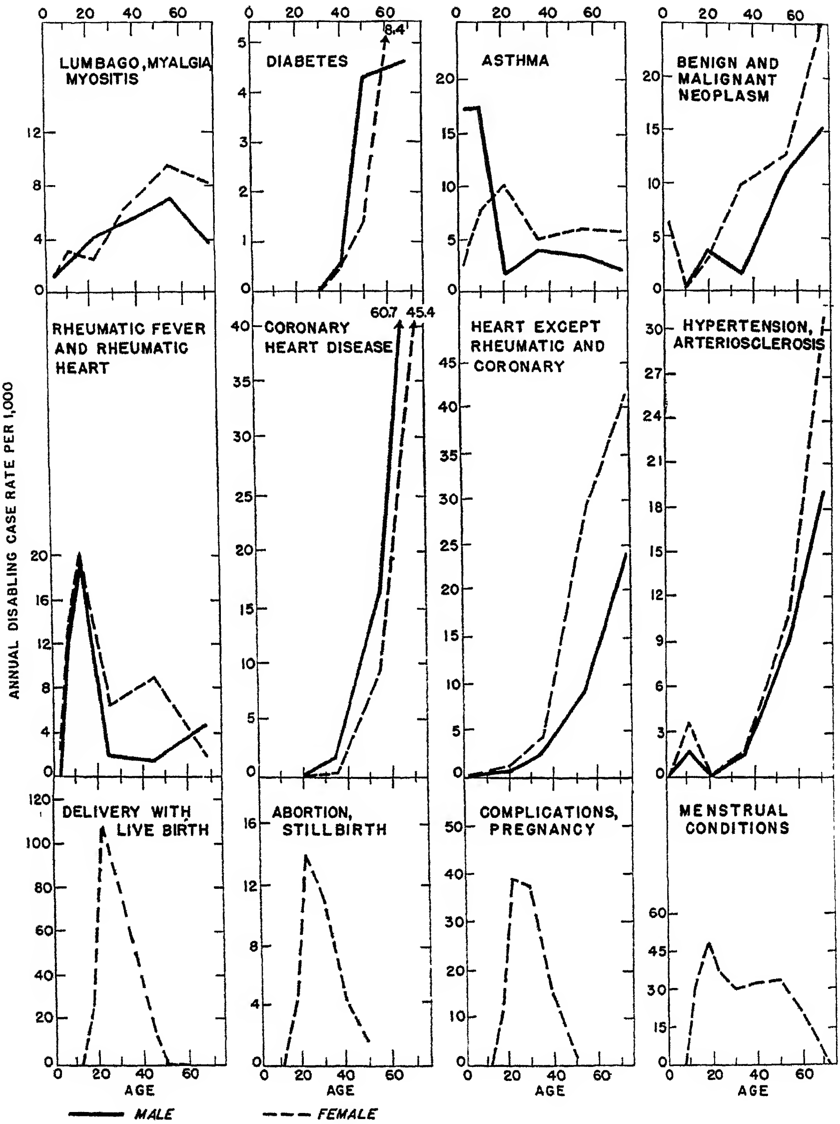

Figure 8. Annual disabling case frequency from specific causes per 1,000 population among white males and females of various ages—Baltimore Eastern Health District sample, 1938–43. (For further details, see note to fig. 7.)

rates for males and females are large and consistent, charts have been made even though the numbers of such cases for one of the two sexes are extremely small. Many diagnoses in which there were too few cases to be of any value in comparing disabling age-specific rates for males and females are omitted from the age curves (figs. 7, 8, and 9)

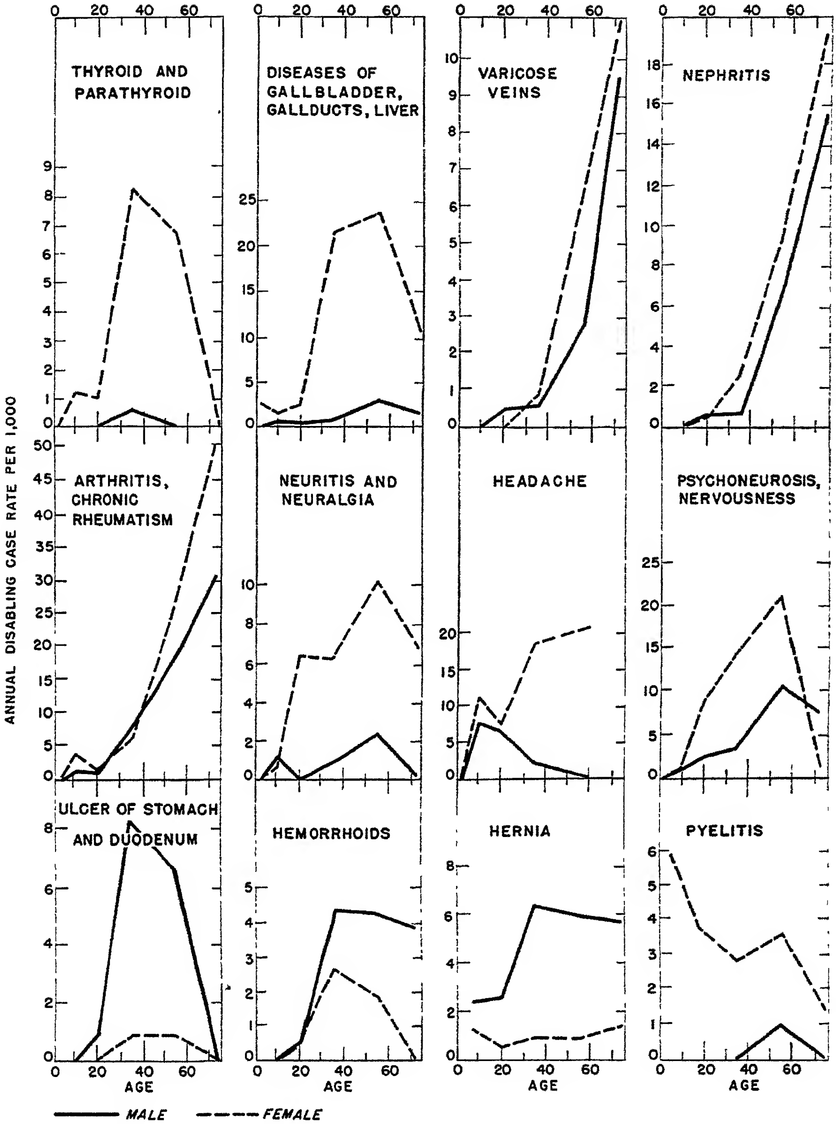

Figure 9. Annual disabling case frequency from specific causes per 1,000 population among white males and females of various ages—Baltimore Eastern Health District sample, 1938–43. (For further details, see note to fig. 7.)

although practically all of them are included in the bar charts (figs. 5 and 6).

There is no need for detailed discussion of these charts. They are intended to show how consistent are the sex differences and at what ages the largest excesses occur. For example, in digestive disturb-

ances and diarrhea the consistent differences come largely in the adult ages, although the latter diagnosis shows considerable difference under 5 years of age. However, in appendicitis and infected teeth all of the age groups except the youngest and oldest show excesses in the disabling rates for females over males.

In figure 9 there is a collection of diagnoses that show extremely wide differences between the disabling rates for males and females—so wide that the sex that has the smaller rate has so few cases that they are inadequate for obtaining a reliable age curve. However, the consistently high rates for the one sex indicate a difference which seems to be significant. These diseases are, for the most part, those that affect the adult rather than the childhood ages, and as a rule they affect the young and middle-aged adults rather than persons in the older ages. The large and consistent excess in disabling rates for males in such diseases as peptic ulcer, hernia, coronary heart disease, and hemorrhoids, are striking but no more so than the excess in disabling rates for females in diseases of the thyroid and parathyroid glands, cholecystitis and diseases of the liver and gall ducts, varicose veins, laryngitis, nephritis, and the minor nervous disorders. In spite of some bias due to women being the usual reporters for the household, these large differences suggest that, in general, women are sick more frequently than men.

Table 3. *Annual disabling acute infectious diseases*[1] *of childhood per 1,000 white males and females of various ages canvassed at monthly intervals in a sample of the Eastern Health District of Baltimore, 1938-43.*

[Sole, primary, and contributory causes]

Diagnoses with code numbers [2]	All ages		Age				
	Number of cases	Rate [3]	Under 5	5-9	10-14	15-24	25 and over
Measles (013):							
Male	171	16.10	107.41	94.12	2.30	----------	0.33
Female	166	15.26	103.18	95.11	7.98	2.99	.31
German measles (014):							
Male	175	16.47	44.44	85.88	57.54	5.09	.98
Female	159	14.61	40.76	89.67	50.17	6.97	.46
Whooping cough (011):							
Male	49	4.61	38.27	20.00	----------	----------	.16
Female	47	4.32	45.86	13.59	1.14	----------	----------
Mumps (016):							
Male	41	3.86	13.58	25.88	6.90	----------	.33
Female	48	4.41	15.29	39.40	3.42	.50	.46
Chickenpox (015):							
Male	101	9.51	55.56	61.18	2.30	----------	.33
Female	81	7.44	43.31	59.78	2.28	.50	----------
Population (years of life):							
Male	10,624		810	850	869	1,963	6,126
Female	10,881		785	736	877	2,010	6,470

[1 2 3] See notes 1, 2, and 3 to table 2.

Table 3 shows rates for the acute infectious diseases of childhood among boys and girls, and table 4 shows rates for female genital and puerperal diseases.

Table 4. *Annual disabling female genital and puerperal cases [1] per 1,000 white females of various ages canvassed at monthly intervals in a sample of the Eastern Health District of Baltimore, 1938-43.*

[Sole, primary, and contributory causes]

Diagnoses with code numbers [2]	All ages		Age					
	Number of cases	Rate [3]	10–14	15–19	20–24	25–34	35–44	45–54
Menstrual disorders (663–664) [4]	285	26.19	30.79	48.42	37.07	29.79	32.60	33.43
Female genital diseases except menstrual disorders (650–656; 658–661; 666; 668–669) [5]	101	9.28	1.14	6.92	11.02	24.47	10.46	10.40
Abortions and stillbirths (674–677; 694–695)	48	4.41		3.95	14.03	11.17	4.31	1.49
Live births (670–673)	324	29.78		23.72	107.21	77.13	28.91	.74
Complications of pregnancy and childbirth (680–689; 690–693; 696; 699)	153	14.06		11.86	39.08	37.77	14.76	2.23
Population (years of life)	10,881		877	1,012	998	1,880	1,626	1,346

[1] [2] [3] See notes 1, 2, and 3 to table 2.
[4] Rate for 55–64 for menstrual disorders is 20.20.
[5] Rates for female genital except menstrual are: Under 5, 1.27; 5–9, 1.36; 55–64, 2 24; 65 and over, 1.38.

Summary

This report deals mainly with disabling illness rates for detailed diagnoses among males and females of specific ages. The data are from the 5-year study made by monthly visits to a sample of the population of the Eastern Health District of Baltimore.

The annual recorded illnesses from all causes which disabled the patient for 1 day or longer amounted to 545 per 1,000 males and 753 per 1,000 females. Annual rates of disabling attacks or episodes of chronic diseases were 60 and 90 per 1,000 males and females, respectively.

Annual days of disability from all causes amounted to 16.1 and 15.7 per male and female observed; 11.0 and 8.9 of these days of disability for males and females, respectively, were due to chronic diseases. However, average prevalence over the 60 months of the study indicated that an average of 35 and 38 per 1,000 males and females, respectively, were disabled on the day of the family interview. These various sex differences in rates are fairly consistent in the several ages (fig. 4).

Annual frequency rates are shown for males and females of all ages for all cases and for disabling cases by detailed diagnoses. Of the 87 tabulated diseases common to both sexes, 60 percent showed higher rates for females and 40 percent showed higher rates for males of all ages combined. Nearly all of the diagnoses with higher disabling rates for females also showed higher total rates (disabling plus non-disabling) for females; the same statement is approximately true for males (figs. 5 and 6).

A few diseases have large and rather consistent sex differences in disabling rates, notably peptic ulcer, hernia, coronary heart disease, and hemorrhoids for men; and for women, thyroid diseases, cholecystitis and liver diseases, varicose veins, nephritis, and the minor nervous disorders. Many other diseases have smaller sex differences in case rates, but the picture does not indicate such higher rates for women as to suggest that the excesses are entirely an artifact of reporting (figs. 7, 8, and 9).

REFERENCES

(*1*) Ciocco, Antonio: Sex differences in morbidity and mortality. Quart. Rev. of Biol. **15:** 59–73; 192–210 (1940).

(*2*) Collins, Selwyn D.: Sickness surveys. *In* Administrative medicine edited by Haven Emerson. Rev. ed. New York, Thomas Nelson and Sons, 1951, pp. 511–535.

(*3*) Collins, Selwyn D.: Cases and days of illness among males and females with special reference to confinement to bed. Pub. Health Rep. **55:** 47–93 (1940). Reprint 2129.

(*4*) Collins, Selwyn D., Phillips, F. Ruth, and Oliver, Dorothy S.: Specific causes of illness found in monthly canvasses of families. Sample of the Eastern Health District of Baltimore, 1938–43. Pub. Health Rep. **65:** 1235–1264 (1950). Reprint 3046.

(*5*) Collins, Selwyn D., Phillips, F. Ruth, and Oliver, Dorothy S.: Age incidence of specific causes of illness found in monthly canvasses of families. Sample of the Eastern Health District of Baltimore, 1938–43. Pub. Health Rep. **66:** 1227–1245 (1951). Reprint 3114.

(*6*) Densen, Paul M.: Family studies in the Eastern Health District. II. The accuracy of statements of age on census records. Am. J. Hyg. **32:** 1–38 (1940).

(*7*) Downes, Jean: Cause of illness among males and females. Milbank Mem. Fund Quart. **28:** 407–428 (1950).

(*8*) Downes, Jean, and Collins, Selwyn D.: A study of illness among families in the Eastern Health District of Baltimore. Milbank Mem. Fund Quart. **18:** 5–26 (1940).

(*9*) Downes, Jean, and Jackson, Elizabeth H.: Medical care among males and females at specific ages—Eastern Health District of Baltimore, 1938–1943. Milbank Mem. Fund Quart. **29:** 5–30 (1951).

(*10*) Gafafer, W. M.: Industrial sickness absenteeism. Males and females, 1948, and males, first and second quarters, 1949; Males and females, 1949, and males, first and second quarters, 1950. Pub. Health Rep. **64:** 1350–1352 (1949); **65:** 1556–1561 (1950). Reprints 2974 and 3059.

(*10a*) Gafafer, W. M.: Sickness absenteeism among male and female industrial workers, 1937–46, inclusive. Pub. Health Rep. **62:** 1538–1541 (1947). Reprint 2817.

(*11*) Gafafer, W. M.: Frequency and duration of disabilities causing absence from work among employees of a public utility, 1938–42. Pub. Health Rep. **58:** 1554–1560 (1943). Reprint 2520.

(*11a*) Gafafer, W. M., and Frasier, Elizabeth S.: Frequency and duration of disabilities causing absence from work among the employees of a public utility, 1933–1937. Pub. Health Rep. **53:** 1273–1288 (1938) Reprint 1963.

(*12*) Jackson, Elizabeth H.: Morbidity among males and females at specific ages—Eastern Health District of Baltimore. Milbank Mem. Fund Quart. **28:** 429–448 (1950).

(*13*) Luykx, H. M. C.: Family studies in the Eastern Health District. IV. Permanence of residence with respect to various family characteristics. Human Biol. **19:** 91–132 (1947).

(*14*) Preas, Sally, and Phillips, Ruth: The severity of illness among males and females. Milbank Mem. Fund Quart. **20:** 221–244 (1942).

(*15*) Reed, Lowell J., Fales, W. Thurber, and Badger, George F.: Family studies in the Eastern Health District. I. General characteristics of the population. Am. J. Hyg. **37:** 37–52 (1943).

(16) Rider, R. V., and Badger, G. F.: Family studies in the Eastern Health District. III. A consideration of issues involved in determining migration rates for families. Human Biol. **15:** 101–126 (1943).
(17) Townsend, J. G., and Sydenstricker, Edgar: Epidemiological study of minor respiratory diseases. Based on records for families of medical officers of the Army, Navy, and Public Health Service and of members of several university faculties. Pub. Health Rep. **42:** 99–121 (1927). Reprint 1133.
(18) U. S. Public Health Service and Johns Hopkins School of Hygiene and Public Health: Unpublished data on censuses in 1933 and 1935–36 of the Baltimore Eastern Health District.
(19) Weissman, Arthur: A morbidity study of the Permanente Health Plan population. Permanente Foundation Med. Bull. **9:** 1–17 (1951).

Elk, Winter Ticks, and Rocky Mountain Spotted Fever: A Query

By Cornelius B. Philip and Glen M. Kohls*

A case of Rocky Mountain spotted fever following tick-bite was reported on the Olympic Peninsula in Washington by Semler (*9*) under circumstances which suggest that the vector was probably the winter tick, *Dermacentor albipictus*, a species heretofore not under suspicion as a carrier because of its presumed one-host habits.

In view of physical findings including rash and history of tick-bite during the previous week, the 35-year-old patient, a regular employee in a plywood mill in Hoquiam, Wash., was hospitalized November 18, 1949, with a tentative diagnosis of Rocky Mountain spotted fever. Chloromycetin therapy was immediately instituted and this probably accounted for subsequent negative complement-fixation findings in accordance with other experience where effective antibiotics have been used early in the course of the disease. This patient was completely afebrile by the third hospital day and his rash had faded by the fourth day. His serum, 4 months later, showed positive *Proteus* OX_{19} agglutination in a dilution of 1:320, which is at least presumptive confirmation of his infection with Rocky Mountain spotted fever.

The authors visited the area in August 1950, and failed to obtain any ticks from the vegetation by flagging, but they obtained the following additional facts by interviewing the patient and others concerned: Three days before onset (a short incubation period), the patient took the day off from his work in Hoquiam and assisted his father and others on his father's farm, between Humptulips and Copalis Junction, in skinning and dressing an elk which others had shot the day before in the adjoining wooded section. This was the only place outside of Hoquiam where the patient had been for a considerable time previous to illness.

Those present noted that ticks were crawling on the hide of the elk, which was pushed under the table on which the patient did some of the butchering. That evening the patient felt an itching near his navel and on examination found an attached tick which his father pulled loose. The patient recognized it only as a fairly large tick, but the father, on being shown both sexes of *D. albipictus* and *Ixodes pacificus* (the two most likely species considering the locality, season,

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and host), without hesitation selected the male of *D. albipictus* as most similar to the tick removed.

D. albipictus has been recorded from the Olympic Peninsula, but no records of *D. andersoni*, the usual vector of spotted fever in the Northwest, are known from this part of the State. November would be very late for adults of the latter to be active. The locality is too far north for either *D. occidentalis* or *D. variabilis* which occur on the Pacific coast farther south earlier in the season. Though there are records of *I. pacificus* on black-tailed deer in California, the season is also late for this according to the records of Cooley and Kohls (*3*). Circumstantial evidence is overwhelmingly in favor of *D. albipictus* as the vector in this instance.

Until now it has been of only academic interest that some of Ricketts' (*7*) early transmission studies in proving the tick-vector theory were undoubtedly with *D. albipictus*. Ricketts stated that three nymphs which had been removed a few days previously from horses in the vicinity of Hamilton, Mont., were fed on a donor guinea pig on January 3. The feeding of the nymphs on horses in midwinter in western Montana leaves little room for doubt, on the basis of present-day knowledge not available then, that the species concerned was *D. albipictus*. One resulting adult within 6 days of molting attached itself to a fresh guinea pig (again indicating *D. albipictus*) and caused "a highly virulent infection" which was fatal in 6 days. Two other guinea pigs to which this tick was transferred for further feeding also had severe infections and died in 8 and 9 days, respectively; one showed an incubation period of only 2 days. This tick is therefore capable of carrying virulent spotted fever.

There is the further possibility that some of the ticks collected from horses, with which Ricketts demonstrated natural infection, were also this species, though unfortunately the dates of collection are not recorded. However, these could as easily have been *D. andersoni* collected in the spring. Because little was known of the taxonomy of ticks at that time, he reported all his observations for *D. "occidentalis,"* but his seasonal and biological accounts clearly concern both *D. albipictus* and *D. andersoni*. It is of further interest that he records being shown "a larval tick which had attached itself to the ear of a child in December [clearly *albipictus*] and in April [possibly so] a nymph obtained from a similar source." Immature stages of ticks are very rarely found on persons in western Montana.

Attachment of *D. albipictus* to man rarely has been observed even in areas where it is abundant on animals, yet hundreds of opportunities occur every winter when large game animals are being killed and dressed. Bishopp and Trembley (*1*) give only one record. During the elk slaughter in Yellowstone Park in January 1950, Philip learned of one other instance in which two adult ticks attached themselves

to a ranger on different occasions (in previous winters) while he was working with elk hides.

During this visit, 51 blood samples were obtained from all ages and sexes of freshly killed elk. At the same time many nymphal and adult *D. albipictus* were obtained from carcasses and from local horses. Negative results were obtained in tests in which the ticks were fed on and injected into guinea pigs, though one animal showed a low febrile episode which was not due to spotted fever, as checked by serology and by challenge with a laboratory passage strain. Excluding 13 serum samples which were anticomplementary, only 2 of the remainder showed even suggestive complement-fixation titers for spotted fever.[1] One showed fixation in dilution of 1:8 against spotted fever antigen, the other 1:16 (as well as 1:8 against the related "maculatum disease") while both were completely negative against Q fever and typhus antigens. It would be of greater interest to test elk or deer serums from known endemic spotted fever areas in the fall.

Howell (*5*) has shown that not all *D. albipictus* remain on the host to molt as presumed for this so-called one-host tick. Some engorged larvae and nymphs were loose in a bag in which they had been experimentally confined on the scrotum of a bull, while horses pastured in infested areas in California and examined weekly over a long period showed definite rhythms of infestation with various stages during the fall and winter, not necessarily coordinated with equivalent prior infestations of the preceding stage. He also was able to collect a few nymphs and adults by flagging the pasture area.

Small animals known to be susceptible to spotted fever are not among the recorded hosts of *D. albipictus* and little is known regarding the susceptibility of the larger animals (particularly the young) which *D. albipictus* customarily attacks. This species was of so little concern in our conception of the epidemiology and natural maintenance of spotted fever that it was not even included in tests of various tick species by Parker, Philip, and Jellison (*6*). Though it is difficult to visualize how the winter tick could play even an incidental role either in nature or in human infection, the above-mentioned case raises an interesting question that may have more than passing interest to those concerned with game management and redistribution as it concerns public health (*4*)—namely, where did this Olympic tick, if it was *D. albipictus* as it appears likely to have been, get its infection?

Summary

A case of Rocky Mountain spotted fever following tick-bite has been reported in which the circumstances strongly incriminate a male

[1] It is of incidental interest here to record that 6 of the 51 elk serums showed positive agglutination in titers of 1:40 or 80, and 1 probable of 1:20 for brucellosis; the remainder were completely negative. These animals all gave negative serologic tests for tularemia.

winter tick, *Dermacentor albipictus*, off an elk hide as the probable vector. Since this is a well-known, one-host species, the question is raised of the source of this tick's infection. This case, reported by Semler (*9*), is the first from the Olympic Peninsula in western Washington.

ACKNOWLEDGMENTS

Thanks are extended to the staff of the Washington State Department of Health for active interest and cooperation in connection with investigation of this case; to Dr. David Lackman of the Rocky Mountain Laboratory, who performed the serological tests; to the staff of the National Park Service, Yellowstone Park; and to Lyndahl E. Hughes, who assisted in obtaining the blood samples from Park elk.

REFERENCES

(*1*) Bishopp, F. C. and Trembley, H. L.: Distribution and hosts of certain North American ticks. J. Parasitol. **31:** 1–54 (1945).
(*2*) Cooley, R. A.: The genera *Dermacentor and Otocentor* (Ixodidae) in the United States, with studies in variation. Nat'l Inst. Health Bull. No. 171, 1–89, 1938.
(*3*) Cooley, R. A., and Kohls, G. M.: The genus *Ixodes* in North America. Nat'l Inst. Health Bull. No. 184, 246 pp., 1945.
(*4*) Holmes, M. A.: Personal communication, 1950.
(*5*) Howell, D. E.: The ecology of *Dermacentor albipictus* (Packard). Proc. Sixth Pacific Sc. Cong. **5:** 439–458 (1939), 1940.
(*6*) Parker, R. R., Philip, C. B., and Jellison, W. L.: Rocky Mountain spotted fever. Potentialities of tick transmission in relation to geographical occurrence in the United States. Am. J. Trop. Med. **13:** 341–379 (1933).
(*7*) Ricketts, H. T.: The role of the wood-tick (*Dermacentor occidentalis*) in Rocky Mountain spotted fever, and the susceptibility of local animals to this disease. A preliminary report. J. A. M. A. **49:** 24–27 (1907).
(*8*) Schwartz, J. E., and Mitchell, Glen E.: The Roosevelt elk on the Olympic Peninsula, Washington. J. Wildlife Management **9:** 295–319 (1945).
(*9*) Semler, L.: Tick fever in Western Washington. Northwest Med. **49:** 183–184 (1950).

Dr. Mountin Succeeds Dr. Williams as BSS Chief

Joseph W. Mountin, M. D.

Charles L. Williams, M. D.

Dr. Joseph W. Mountin, on November 1, 1951, succeeded Dr. Charles L. Williams as chief of the Bureau of State Services of the Public Health Service. Dr. Williams, who received his commission in 1912, has retired after nearly 40 years of active duty. His successor, Dr. Mountin, entered the Service in 1917 and has been an associate chief of the Bureau since 1947.

In recent years, Dr. Mountin has been chief spokesman for the Bureau in the fields of chronic disease control and health programs for the aging. He is an advocate of better coordination of hospital and local health facilities. The Communicable Disease Center at Atlanta, Ga., and the Arctic Research Center at Anchorage, Alaska, were established largely through Dr. Mountin's efforts.

The notable career of Dr. Williams includes direction of a bubonic plague laboratory and administration of the Foreign Quarantine Division which he reorganized and streamlined. He set up the first interstate sanitary laboratory. During his early years, Dr. Williams became one of the country's authorities on plague. On September 1, 1946, he was appointed chief of the Bureau of State Services. During his administration he did much to bring the knowledge of medicine and public health into the homes and communities of the people.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

Announcement

The new monthly Public Health Reports (see back cover) will publish from time to time, as appropriate, reports, tabulations, and articles dealing with morbidity statistics, both domestic and foreign. The present weekly "Incidence of Disease" section, however, will be discontinued as of December 31, 1951.

Current provisional morbidity data on notifiable diseases for the United States will continue to appear in summary form and in tabulations by States and cities in the weekly *Morbidity Report* issued by the National Office of Vital Statistics of the Public Health Service.

Libraries and agencies that have depended upon Public Health Reports for current morbidity statistics for the United States may continue to receive the same data by writing to the National Office of Vital Statistics, Public Health Service, Washington 25, D. C., requesting that they be placed on the mailing list for the weekly *Morbidity Report.* Individuals who wish to be placed on the mailing list should indicate how and to what extent they will make use of this publication.

Since the *Weekly Epidemiological Record* and other publications of the World Health Organization, Geneva, Switzerland, contain morbidity data for foreign countries, tabulations of notifiable diseases occurring outside the United States and its Territories will not appear regularly in National Office of Vital Statistics publications.

UNITED STATES

Reports From States for Week Ended November 24, 1951

The incidence of measles increased as compared with the previous week and for the same week last year. Approximately three-fourths of the cases for the current week were reported in the northeastern States. Since the seasonal low week (about September 1) 20,144 cases have been reported as compared with 12,700 for the same period of 1950.

There was a 30-percent decrease in the number of cases of poliomyelitis reported this week as compared with the previous week. The cumulative total for the calendar year is now 27,163, as compared with 31,357 for the same period of 1950. The cumulative total since the seasonal low week this year is 25,951 and 30,226 for 1950.

Only five cases of malaria in civilians were reported for the current week, one each in Wisconsin, Missouri, Arkansas, Oklahoma, and California. The case reported in California was in a Mexican recently

arrived from Mexico. There was a substantial decrease in the number of cases of malaria reported from military establishments.

Epidemiological Reports

Influenza

The Influenza Information Center, National Institutes of Health, has received information that a rather explosive outbreak of acute respiratory infections occurred among recruits at the Great Lakes Naval Training Center during the last week of October. About 25 percent of the recruits were affected in a sample of 2,250 persons interviewed. All regiments were involved about equally and men in all weeks of training were equally attacked. The predominating symptoms were sore throat, malaise, chills, and fever. Although studies are incomplete, four cases have shown significant rises to the Lee strain of virus in convalescent blood by either Hirst or complement fixation techniques. Viruses have been recovered from five patients thus far, and are being passed in eggs. They have been slow growing and yield a low titer. Only one of the five patients from whom virus was recovered has serological evidence of influenza B in the early convalescent sera. The exact relationship between influenza B virus and the outbreak of acute respiratory infections cannot be stated until further laboratory examinations are made.

Trichinosis

Dr. M. Goodman, New York State Department of Health, has reported a family outbreak of trichinosis in Westchester County. In the investigation by Dr. R. F. Sikes, it was found that five members of a family became ill with periorbital edema, myalgia, syncope, and vomiting several days after eating meat sausage containing pork and beef. It was said to have been cooked in tomato sauce for 2½ hours.

Gastroenteritis

Dr. R. H. Hutcheson, Tennessee Commissioner of Public Health, has reported an outbreak of food infection which occurred in a small college (675 students) located in the eastern part of the State. A total of 193 persons, it was reported, became ill 10 to 36 hours after eating chicken. The majority became ill after a Sunday noon meal, but 30 additional cases occurred after the evening meal on the following day. Fried chicken was the food common to both meals. Although no food was available for examination, the history indicated fried chicken was the vehicle of infection. Seven foodhandlers showed positive stool cultures for *Salmonella oranienburg* and all gave histories of illness after eating the Sunday meal. The chickens were obtained from a packing house and an attempt is being made to trace infection

back to its original source. This is the first isolation of *S. oranienburg* in Tennessee.

Dr. C. P. Stevick, North Carolina Board of Health, has reported an outbreak of bacillary dysentery which occurred among pupils attending a school. The number of persons exposed to infection was 315 and the number reported ill was 153. Dr. M. P. Rudolph, District Health Officer, found that although *Shigella sonnei* was discovered to be the causative agent, it was difficult to establish a definite carrier relationship that would account for the cases as they were distributed in the school. Two teachers and all pupils from whom specimens were obtained in the second grade and one teacher and one pupil in the sixth grade had positive stool cultures. It could not be established definitely that the teachers were the primary source of infection nor was it possible to determine the vehicle of infection.

Dr. J. T. Herron, Arkansas Health Officer, has reported an outbreak of food poisoning following the eating of ham at a club dinner. *Staphylococcus albus* was isolated from this food.

Dr. M. H. Merrill, California Department of Public Health, has reported an outbreak of salmonellosis in which turkey sandwiches are suspected as the vehicle of infection. A total of 31 cases was found among 41 persons who partook of a midnight supper. Stool specimens from 26 of the cases were obtained, 22 of which contained *Salmonella typhimurium*. A frozen turkey was roasted, cooled at room temperature, and after slicing was left unrefrigerated. Specimens of

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946-50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945-46 through 1949-50	Cumulative total for calendar year—		5-year median 1946-50
	Nov. 24, 1951	Nov 25, 1950			1950-51	1949-50		1951	1950	
Anthrax (062)	------	1	1	(1)	(1)	(1)	(1)	56	42	47
Diphtheria (055)	86	116	240	27th	1,705	2,296	4,080	3,713	5,424	8,691
Encephalitis, acute infectious (082)	9	29	10	(1)	(1)	(1)	(1)	[2] 940	915	599
Influenza (480-483)	314	693	920	30th	5,769	9,039	9,039	121,824	147,803	136,851
Measles (085)	3,401	2,026	2,026	35th	20,144	12,700	12,596	489,055	300,871	572,953
Meningitis, meningococcal (057.0)	72	64	59	37th	644	601	574	3,705	3,400	3,128
Pneumonia (490-493)	824	1,070	(3)	(1)	(1)	(1)	(1)	54,120	73,251	(3)
Poliomyelitis, acute (080)	399	568	506	11th	[4] 25,951	30,226	25,865	[4] 27,163	31,357	26,215
Rocky Mountain spotted fever (104)	2	2	3	(1)	(1)	(1)	(1)	328	451	548
Scarlet fever (050)[5]	1,048	1,021	1,480	32d	8,856	9,321	12,510	62,242	49,491	68,358
Smallpox (084)	------	4	2	35th	[6] 1	7	7	[6] 12	33	52
Tularemia (059)	6	10	21	(1)	(1)	(1)	(1)	580	802	873
Typhoid and paratyphoid fever (040, 041)[7]	48	49	50	11th	2,449	2,694	3,133	2,884	3,203	3,618
Whooping cough (056)	1,179	1,640	1,904	39th	8,477	13,066	13,066	62,252	110,261	89,685

[1] Not computed. [2] Deduction: Missouri, week ended November 3, 1 case. [3] Data not available. [4] Addition: Missouri, week ended November 3, 1 case. [5] Including cases reported as streptococcal sore throat. [6] Deductions: Ohio, weeks ended November 3 and 10, 1 case each. [7] Including cases reported as salmonellosis.

the turkey meat were negative. Two persons preparing the food were ill following the supper.

Anthrax

The human case of anthrax reported from California last week occurred in a known anthrax endemic area with cases in dairy herds. Another case previously reported was in a ranch employee who lived in an area where 30 sheep have been found to have the disease.

Botulism

Dr. Merrill has reported three fatal cases of botulism in Los Angeles County, California. A home-canned food is suspected as the source of infection. The three persons who died were the only ones who ate the suspected food.

Plague Infection in Lincoln County, Washington

The following was proved to be plague infected: A specimen consisting of 306 fleas, *Megabothris clantoni, Thrassis gladiolis johnsoni, Micropsylla sectilis, Catallagia charlottensis, Monopsyllus wagneri*, and *Malaraeus telchinum*, from 106 sagebrush voles, *Lagurus curtatus*, trapped October 26, 17 miles southwest of Davenport in Lincoln County, Wash.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Nov. 24, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**86**	**9**	**314**	**3,401**	**72**	**824**	**399**
New England	**2**	**1**	**5**	**541**	**4**	**44**	**12**
Maine			4	94		6	
New Hampshire			1	15		8	
Vermont				134			
Massachusetts	2	1		172	2		4
Rhode Island				52			
Connecticut				74	2	30	8
Middle Atlantic	**6**		**2**	**1,418**	**8**	**86**	**29**
New York	3		(1)	583	3		18
New Jersey			2	320	1	41	5
Pennsylvania	3			515	4	45	6
East North Central	**7**	**5**	**23**	**563**	**8**	**85**	**52**
Ohio				144	4		8
Indiana	1		23	39		10	9
Illinois		2		148	2	58	12
Michigan	6	3		178	2	17	12
Wisconsin				54			11
West North Central	**3**		**11**	**70**	**6**	**53**	**35**
Minnesota	2			12	2	3	6
Iowa				2	2	2	2
Missouri			1	3			12
North Dakota			9	31	2	30	3
South Dakota				7			1
Nebraska				6			4
Kansas	1		1	9		18	7
South Atlantic	**33**		**19**	**278**	**11**	**115**	**33**
Delaware				1			
Maryland				132	1	34	8
District of Columbia				18	1	14	
Virginia	7			44	1	57	4
West Virginia	2			16	2		6
North Carolina	8			2	2		7
South Carolina	4		8	2	1	2	
Georgia	12		11	48	1	8	3
Florida				15	2		5
East South Central	**22**	**2**	**6**	**84**	**10**	**38**	**23**
Kentucky	3		2	42			1
Tennessee	5	2		13	7		6
Alabama	10			22	2	21	6
Mississippi	4		4	7	1	17	10
West South Central	**11**		**85**	**57**	**9**	**267**	**62**
Arkansas	1		36	5		33	12
Louisiana	4				1	12	6
Oklahoma	4		49	3	1	21	2
Texas	2			49	7	201	42
Mountain	**1**		**111**	**199**	**3**	**61**	**39**
Montana				47			4
Idaho				6			3
Wyoming				1		4	8
Colorado			5	13		12	7
New Mexico			1	21	1	21	4
Arizona	1		105	20	1	24	
Utah				91	1		13
Nevada							
Pacific	**1**	**1**	**52**	**191**	**13**	**75**	**114**
Washington			28	67	2		8
Oregon			14	15	1	36	7
California	1	1	10	109	10	39	99
Alaska							
Hawaii			2	545	1	3	9

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended November 24, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States	2	1,048		6	48	1,179	145
New England		66			4	114	
Maine		8				2	
New Hampshire		5				9	
Vermont						13	
Massachusetts		33			4	76	
Rhode Island		6				6	
Connecticut		14				8	
Middle Atlantic		154[3]			4	207	21
New York		77			1	67	12
New Jersey		22				77	9
Pennsylvania		55			3	63	
East North Central		283		1	7	271	15
Ohio		94			3	58	6
Indiana		23			2	49	5
Illinois		28		1	1	35	
Michigan		100			1	72	
Wisconsin		38				57	4
West North Central		78			2	39	9
Minnesota		14				7	4
Iowa		23			1	3	4
Missouri		14				9	1
North Dakota						2	
South Dakota							
Nebraska						2	
Kansas		27			1	16	
South Atlantic	2	136			8	133	16
Delaware		3					
Maryland		13				10	
District of Columbia		6				2	
Virginia	1	21			1	32	3
West Virginia		14				36	
North Carolina	1	59			5	13	3
South Carolina		1			1	3	2
Georgia		17			1	16	8
Florida		2				21	
East South Central		80		1	3	41	22
Kentucky		28				9	8
Tennessee		33		1	3	18	8
Alabama		13				7	2
Mississippi		6				7	4
West South Central		31		3	6	236	62
Arkansas		4		1	1	9	3
Louisiana		2			1	3	[3] 25
Oklahoma		7			3	6	4
Texas		18		2	1	218	30
Mountain		48		1	2	46	
Montana		11		1		3	
Idaho		10				4	
Wyoming		1					
Colorado		4			1	16	
New Mexico		4				10	
Arizona		5			1	10	
Utah		10				3	
Nevada		3					
Pacific		172			12	92	
Washington		21				8	
Oregon		26			1	1	
California		125			11	83	
Alaska							
Hawaii		1			1		

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.
[3] Report for October.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Nov. 10, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	3					2	1				
Chickenpox	963	4		18	1	125	495	31	47	124	118
Diphtheria	8					7					1
Dysentery:											
Amebic	6					6					
Bacillary	11						2				9
German measles	108			4		21	25	1	11	36	10
Influenza	22			22							
Measles	662	9		10	1	16	106	26	6	249	239
Meningitis, meningococcal	5					1	2	1			1
Mumps	519	5		2		110	259	19	31	26	67
Poliomyelitis	30			6		6	12	5			1
Scarlet fever	435	2			1	114	55	29	45	27	162
Tuberculosis (all forms)	299	15		2	30	104	29	18	32	9	60
Typhoid and paratyphoid fever	7					7					
Venereal diseases.											
Gonorrhea	262	2		4	7	53	47	28	17	43	61
Syphilis	62	2		3	1	26	10	3	4	5	8
Primary	2					1			1		
Secondary	3						2			1	
Other	57	2		3	1	25	8	3	3	4	8
Whooping cough	256	5				101	58	28	7	36	21

NEW ZEALAND

Reported Cases of Certain Diseases and Deaths—5 Weeks Ended Sept. 29, 1951

Disease	Cases	Deaths	Disease	Cases	Deaths
Brucellosis	9		Malaria	1	
Diphtheria	4		Meningitis, meningococcal	19	1
Dysentery:			Ophthalmia neonatorum	1	
Amebic	3		Poliomyelitis	2	
Bacillary	3		Puerperal fever	6	
Encephalitis, infectious	1		Scarlet fever	88	
Erysipelas	16		Tetanus	1	1
Food poisoning	5		Tuberculosis (all forms)	181	58
Influenza	3	2	Typhoid fever	13	1

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Cholera

India. The number (632) of cases of cholera in India for the week ended October 20 was less than a third of the average (2,117) for the period of high incidence, from the middle of July to September 15. For the week ended November 10, 50 cases were reported in Calcutta.

Plague

India. During the week ended October 20, 100 cases of plague were reported in States of India as compared with 58 for the previous week. No cases of plague have been reported in the ports since August 18, when one imported case was reported in Calcutta.

Smallpox

French Equatorial Africa. During the period November 1–10, 18 cases of smallpox were reported as compared with 84 for the previous 10-day period. For the period November 1–10, one fatal case was reported in Fort Lamy.

Indochina. For the week ended November 10, eight cases each were reported in Haiphong and Hanoi, Viet Nam.

Typhus Fever

Iraq. One case of typhus fever was reported in Baghdad for the week ended November 17.

Italy. During the 3-week period ended November 3, 166 cases (4 deaths) of endemic typhus fever were reported in Genoa.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work.

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Librarians and others should preserve their copies for binding, as the Public Health Service is unable to supply the general demand for bound copies. Indexes will be supplied upon request.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON D. C. : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C
Price 15 cents. Subscription price—per year $4.75, domestic; $6.25 foreign.

—Announcement—

PUBLIC HEALTH REPORTS

To be Published Monthly Next Year

Beginning in January 1952 PUBLIC HEALTH REPORTS will be published monthly. Two other technical publications of the Public Health Service—the Journal of Venereal Disease Information and the CDC Bulletin—are being merged with it.

The merger has come about as the result of an extended study of the Public Health Service's publishing activities. The new journal is designed to carry out more efficiently and economically the Public Health Service's responsibilities for disseminating scientific information on matters of health.

The new PUBLIC HEALTH REPORTS will be concerned with the technical and professional aspects of public health practice, with problems of health administration, and with research in these fields. It will include substantially the types of material that have been appearing in the three present journals and the monthly Tuberculosis Control Issue of PUBLIC HEALTH REPORTS. There will be more emphasis, however, on administrative practice, program development, and applied research aspects and less emphasis on bench research and clinical material not rather directly related to public health practice.

As has been true with each of the present journals, the pages of the new PUBLIC HEALTH REPORTS will be open, on merit, to any responsible author. General editorial guidance will be provided by a Board of Editors composed of individuals of recognized competence and professional stature drawn from both within and outside the Federal service.

Every effort will be made to furnish the new PUBLIC HEALTH REPORTS to representative organizations in public health and its related fields. Most of the readers on the mailing list are affiliated with organizations to which free distribution can legally be made. They will continue to receive the new journal either directly or through these organizations.

The first issue of the new PUBLIC HEALTH REPORTS and an application form for a free subscription will be sent to readers now on the free lists for technical periodicals. After they have had an opportunity to review the new PUBLIC HEALTH REPORTS and to consider its usefulness in their work, readers who wish to remain on the lists and receive the new periodical regularly should complete the application and send it in as soon as possible. This will allow time to revise the lists for mailing the second and subsequent issues.

The new PUBLIC HEALTH REPORTS will also be available by paid subscription from the Superintendent of Documents, Government Printing Office.

Public Health Reports

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A Biochemical Study of Experimental Q Fever Infection in the Bovine Mammary Gland

By Richard A. Ormsbee*

This investigation was made to study several aspects of bovine mammary gland metabolism as they were influenced by experimentally induced infection with *Coxiella burnetii*, the causative agent of Q fever. The data reported represent only a part of the clinical, epidemiological, and pathological information obtained from a study of six cows. Additional details will be published later (*1*).

Material and Methods

Six young cows in the second and third months of their first lactation period were used in the experiment. Four were experimentally infected and two served as controls. Prior to initiation of the experiment, the cows were free of mastitis, as indicated by leukocyte counts and blood agar cultures.

Representative milk samples from the total morning milking from each quarter of the udder of each cow were taken three times a week until the acute phase of the infection was past. Samples were then taken once a week. Samples were also taken during the 10 days preceding inoculation with *C. burnetii.*

The cows were inoculated with *C. burnetii* (a California strain) by the injection of 20-ml. aliquots of 2.5 percent infected chick yolk-sac tissue via the lacteal duct. The infectious suspension was made up in 0.85 percent NaCl and contained 2.5×10^9 guinea pig infectious doses per milliliter. The infected yolk-sac material came from 13-day-old chick embryos; the corresponding normal yolk-sac suspension used in the control cattle came from 12-day-old chick embryos. The two control cows were injected in the left front and right rear, and the right front and right rear quarters, respectively. The animals receiving the infectious suspension were injected in the left front and left rear quarters in all cases.

*From the Rocky Mountain Laboratory (Hamilton, Mont.), National Microbiological Institute, National Institutes of Health, Public Health Service.

Butterfat determinations were made according to the procedure described by Goss and Rudnick (*2*).

The pH determinations were made with a glass electrode. These determinations were accurate to 0.02 units.

Lactose determinations were made following the Folin-Wu method for blood sugar. To 2 ml. of milk in a 25-ml. volumetric flask, 18 ml. of a mixture of eight parts of N/10 H_2SO_4 and one part of 10 percent Na_2WO_4 was added slowly and with shaking. This was allowed to stand 5 minutes and then diluted to volume with distilled water. The filtrate from this preparation was diluted 3:25, and 1 ml. of the diluted filtrate was used for the lactose determinations (*3*).

Chloride determinations were performed by adding 5 ml. of $AgNO_3$ (2.905 gm/1.) to a 5-ml. aliquot of a filtrate prepared as described in the preceding paragraph. To this was added 5 ml. of concentrated HNO_3 and 0.3 gm. $FeNH_4(SO_4)_2 \cdot 12\ H_2O$. This mixture was titrated in ice water to a 15-second persisting end point with KCNS of such a concentration that 5 ml. was equivalent to 1 ml. of the $AgNO_3$ solution.

Total nitrogen determinations were made by the usual micro-Kjeldahl method and nesslerization of the distillate.

Casein was determined by a method involving the use of KH_2PO_4 as the precipitating agent. To a 25-ml. aliquot of milk diluted 1:50 with distilled water was added 25 ml. of M/4 KH_2PO_4. The mixture was allowed to stand 60 to 90 minutes, during which time the casein was precipitated as a fine flocculate. If precipitation was delayed, the addition of 0.1 ml. of 10 percent HAc caused rapid completion. The mixture was then filtered through Whatman No. 2 paper and washed with M/4 KH_2PO_4 to a total wash volume of about 75 ml. The precipitate was then dissolved by the drop-wise addition of 10 percent NaOH which was also used for rinsing out the original flask. A total volume of 15 ml. of 10 percent NaOH was employed, and the filter subsequently washed with water. The NaOH and wash waters were collected in a 25-ml. volumetric flask and made up to volume. N determinations were made on 1-ml. aliquots by the method previously described. The amount of casein was calculated on the basis of 15.7 percent N content. A comparison of this method of casein determination with other methods will be published at a later date.

Total solids were measured by weighing out approximately 3 ml. of milk into a 6.5-cm. Vycor evaporating dish and drying it at 96° for 24 hours. The dish then was stored in a desiccator until weighed.

Total ash was determined by weighing out approximately 20 ml. of milk in an 8.5-cm. Vycor evaporating dish and adding 6 ml. of concentrated HNO_3. This was digested cautiously over a micro-burner and then ashed at a temperature below redness until free of

carbon. Removal of carbon was accelerated by the cautious dropwise addition of 30 percent H_2O_2. The samples were then cooled and left in a desiccator overnight before weighing.

Hemoglobin was measured colorimetrically as acid hematin. A 0.2-ml. aliquot of heparinized blood made up to 50 ml. with N/10 HCl was allowed to stand for 1 hour at room temperature, and the absorption measured at 540 mμ.

Results

A summary of the most important data is presented in table 1. The data given in this table cover only the period beginning 4 days before infection and the 12 days following infection. The major changes noted took place during this period. Determinations were actually made on the animals beginning 10 days before infection and lasting until the animals were killed—a period of 41 days postinoculation in some cases. Although individual determinations were made on each quarter of the udder of each cow, only the data on the quarters actually injected with normal or infectious yolk-sac suspensions are presented. The effects on the uninjected quarters are noted in the appropriate sections.

Table 1. *Summary of the changes occurring as a result of experimental Q fever infection, including data for the injected quarters of the udders only*

	A	B	C		A	B	C
	Milk volume in ml.				*Butterfat, gm. percent*		
Control	963	415	848		4.2	4.7	3.8
Infected	1148	276	792		3.3	7.7	3.7
	Chloride, mg. percent				*Total nitrogen, mg. percent*		
Control	77	114	65		579	767	449
Infected	87	201	187		500	818	553
	Casein, mg. percent				*Lactose, gm. percent*		
Control	[1] 2380	[2] 1950	2370		6 09	4.28	5.32
Infected	[1] 2040	[2] 1760	2380		5 46	3 39	4.43
	Dry wt., gm. percent				*Total ash, gm. percent*		
Control	12.90	13.53	12 28		[3] 0.96	-------	[4] 0 68
Infected	11.47	16 39	12 78		[3] 1 02	-------	[5] .66
	pH				*Hemoglobin, gm. percent*		
Control	6.49	6 61	6.51	(2 animals)	10.0	11.3	10.6
Infected	6.46	6.65	6 56	(3 animals)	10.3	10.1	11.0

[1] Average value 7 to 11 days before injection.
[2] Complete series of determinations not made. Minimum value during first 8 days postinjection may have been lower. These values were obtained after dry weight values had returned almost to normal.
[3] Determinations made only once, 10 days before injection.
[4] Determinations made 42 days after injection.
[5] Determinations made on one cow only, 42 days after injection.

NOTE: Column A gives the average value during the 4 days preceding injection; column B the average maximum or minimum value obtained during the 8 days following injection; column C gives the average value during the eighth to the twelfth days postinjection. In the group designated "Control" each value represents the average value obtained from 4 quarters of the udders (2 from each of 2 cows). In the "Infected" group, each value represents the average value from 6 quarters (3 cows), unless otherwise indicated. The values are for morning milk only, except for the hemoglobin values, which are for blood.

Milk Production

The volume of milk from each of the four quarters of the udder of a given cow varied considerably during the preinoculation period, as well as later. The injection of an infectious yolk-sac suspension into a given quarter resulted in a drastic fall in milk volume from 5 to 20

percent of normal. A similar drop, though not as great, occurred in the uninjected quarters. Beginning with the fourth day postinoculation, volume rapidly rose to near normal levels in both the injected and uninjected quarters. Milk volume never again, in the time period studied, reached the average preinjection level.

Milk flow from the quarters injected with normal yolk-sac suspensions likewise dropped but not as much as in the quarters injected with infectious material. Recovery was more rapid. The uninjected quarters of the control animals showed only a slight drop in milk production.

Butterfat

The percent of butterfat was only slightly affected in the control animals. However, the total butterfat production dropped significantly in these animals, particularly in the inoculated quarters, because the milk production dropped immediately following inoculation. This transitory decrease in butterfat production had largely disappeared by the eighth day following inoculation.

In the experimental animals the butterfat concentration increased markedly, particularly in the inoculated quarters, going as high as 9.9 percent in the inoculated quarters of one cow. Although the butterfat concentration increased markedly in the infected quarters of the experimental animals, there was a decrease in total butterfat much greater than that in the control animals because of the extreme decrease in milk volume in the infected animals.

The average percent of butterfat in the infected quarters rose about twofold and then dropped to normal within the 8 days following infection. A somewhat smaller rise occurred in the uninjected quarters of the experimental animals.

Lactose

A slight drop in lactose concentration following inoculation was noted in both the injected and uninjected quarters of the control animals.

The lactose concentration in the infected quarters of the experimental animals declined 38 percent immediately following inoculation, whereas the control quarters in these animals were relatively unaffected. Within 8 days, postinoculation lactose content was normal or nearly so in all cases although the return to normal values was more protracted than in the control animals.

Chloride

In the control animals a gradual decrease in milk chloride concentration was noted during the 10-day preinoculation period. This was likewise true of the experimental animals. Immediately following inoculation a sharp, but relatively small rise in concentration was

noted in the control animals. This was more marked in the injected quarters.

In the experimental animals the chloride concentration in the infected quarters rapidly rose far above those in the uninfected quarters of the udders of the same animals. The values in the infected quarters equaled the values of the corresponding normal quarters by the seventh day in one animal, and by the fourteenth day in the second, but never did reach the lower chloride concentration of the control quarters in a third, up to the time of sacrifice on the twenty-second day. The average maximum increase in chloride in the infected quarters was twofold.

Total Nitrogen

In the control animals a slight rise in nitrogen concentration was noted in the injected quarters on the day immediately following injection. The level had dropped to control values by the time the next determinations were made, 4 days following injection. The total nitrogen content of all quarters in the control animals fell to a level of about 78 percent of the preinjection value and was subsequently maintained at this level.

In the infected animals a sharp rise in total nitrogen occurred in the milk from the injected quarters, with a peak equaling 164 percent of normal on the fourth day. A fall in the total nitrogen of the corresponding uninjected quarters occurred. The peak nitrogen content in the milk from the injected quarters came simultaneously with the lowest ebb of milk production, and probably reflects protein concentration. NPN determinations were not made so it is not known whether or not the rise in total N reflects only protein concentration or whether an increase in NPN also occurred at this time. It is very likely that a rise in NPN did occur. The total N concentration in the milk from the injected quarters did not drop to the values obtained from the uninjected quarters until 20 days postinjection.

Casein

No evidence of significant fluctuations in casein concentrations in the milk from the control quarters as opposed to the injected quarters was noted in either the control animals or the experimental animals. Nor was the relative casein production in the experimental animals markedly altered as compared with the controls. These data, however, cover only part of the preinoculation period and only the postinoculation period beginning 6 days after inoculation. Since these data do not cover the period in which the greatest fluctuations occurred in the other constituents measured, no conclusion can be drawn concerning the influence of the experimental treatment on the casein content of the milk during the period in which marked changes were most likely to occur.

Dry Weights

Dry weight determinations of milk samples showed a marked but erratic fluctuation in the control animals in the 6 days immediately following injection. In one control animal no change occurred in the uninjected quarters. In the other control animal a marked drop in dry weight values from the injected quarters and a smaller but significant drop in the uninjected quarters occurred.

In the experimental animals, a rise in dry-weight values occurred in all quarters, both injected and uninjected. This rise was maximal 4 days following injection or at the time of minimum milk production and was much greater in the injected quarters than in the uninjected quarters. One cow was a partial exception to this in that the highest dry-weight values in the infected quarters were observed 6 days following injection, at a time when milk production was increasing from its low point on the fourth day. The uninjected quarters in this cow showed a decrease in dry-weight value on the sixth day. The values from the injected quarters as compared to the corresponding control quarters were approximately equal in the control animals by the sixth day following injection. This was likewise true in a second animal. In a third animal, however, the values from the control and infected quarters were never equal up to the time of sacrifice on the eleventh day following injection. In a fourth animal, values were approximately equal by the fifteenth day following injection although true equality did not obtain until the day of sacrifice, 22 days following injection. Dry-weight increases up to 158 percent of normal were observed. The average maximum increase in dry-weight values was 43 percent above normal and occurred in the injected quarters of the infected cows. Total ash measurements made in the preinjection period again just prior to sacrifice indicated no significant differences between the control and the experimental animals.

pH Changes

A small increase in the pH of the milk from the control animals was detected. The injected quarters were indistinguishable from the uninjected quarters in this regard.

Similar fluctuations in the pH of the milk from the infected cows occurred. They were more marked in the injected than in the uninjected quarters. In all cases the pH of the milk from injected quarters rose 0.1 to 0.2 units during the 8 days immediately following injection. This was accompanied by a rise in pH in the corresponding uninjected quarters in all cases. The values returned to values closely approximating the preinjection figures within 11 days in the case of two animals. In the third infected animal, the pH of the milk did not return to its preinfection value within 22 days, at which time the animal was killed. The magnitude of the pH changes was slight.

Control (preinjection) values averaged pH 6.46, and the average maximum value obtained in the 8 days following inoculation was pH 6.65.

Hemoglobin

Blood hemoglobin determinations made revealed no significant variations that could be ascribed to Q fever infection. The initial control values for the individual animals varied considerably, and later changes revealed no regular trend in concentration that could be ascribed to the experimentally induced infections.

Discussion

The changes that were noted occurred chiefly during the 8 days following injection. They were essentially similar in the control animals which had been injected with a normal chick yolk-sac suspension and in the experimental animals which had been injected with a corresponding suspension of infectious material. The major difference between the control and the experimental values lay in the magnitude and the duration of the changes, particularly with respect to butterfat and chloride. In the control animals, the changes resulting from the introduction of normal yolk-sac suspension were smaller in magnitude and recovery was rapid. In the experimental animals, the magnitude of the changes was greater and recovery to normal was considerably slower. Even so, most of the abnormal variations in milk composition had disappeared within the 8 days following infection. This 8-day period following injection also covered the appearance and disappearance of fever in the infected animals. No fever occurred in the control animals.

It seems reasonable to conclude that the major cause of the changes observed in the experimentally infected animals was the introduction in the udder of massive amounts of foreign protein. It is also clear, however, that changes in all constituents occurred in these animals above and beyond those nonspecific reactions caused by the yolk-sac components injected. Thus, the magnitude and duration of the changes which occurred in the infected animals can be attributed to the Q fever infection. This was particularly clear in one of the experimental cows in which the differences persisted for 22 days following injection. The most acute deviations from normal in this animal occurred several days after the appearance of the corresponding deviations in the control animals.

This animal, incidentally, represented the only case in which the original infection spread to an uninjected quarter of the udder. The animal was injected in the left front and left rear quarters, and 7 days later the milk from the right rear quarter became positive for Rickettsiae, and remained so until sacrificed, 63 days after injection.

Table 2 presents a comparison (with the present findings) of the changes that occur during chronic bacterial mastitis (*4*). The most characteristic changes in the chemical composition of milk from udders with bacterial mastitis are increases in chloride, water, noncasein nitrogen, and pH, and decreases in casein, lactose, milk fat, nonfat solids, and ash. There may be a considerable decrease in milk volume also. The changes that occurred following infection with *C. burnetii* differ from those found in chronic bacterial mastitis in that there is a large increase in milk fat, in solids other than fat, and a relatively small increase in pH. The milk taken at the most acute stage was very thick and creamy in appearance, with butterfat values up to 9.9 percent and total solids values up to 19.1 percent.

The infected cows shed Rickettsiae in their milk until they were killed, or for periods of 5, 11, 22, and 63 days, respectively, following injection. The Rickettsiae were demonstrated by guinea pig inoculation. It thus appears that none of the measurements made were critical in indicating the existence of any Q fever infection except the most acute, since the infections persisted long after the milk had returned to normal. The acute Q fever infection, as exemplified by the foregoing data, is reflected in changes which were concerned with cellular synthetic activities, or with the integrity of epithelial cell membranes.

These data indicate that *C. burnetii* infection produces only temporary metabolic changes in mammary gland activity, even when the organism is injected in massive doses. Milk volume, butterfat, casein, total nitrogen, lactose, chloride, and total solids, all assumed relatively normal levels within 3 weeks at most following infection and within 8 days for three out of four experimental animals. One exception may have been the declining milk volume noted from the twenty-eighth to the forty-first day in one infected animal.

No systemic involvement reflected in hemoglobin concentration changes or in blood cell counts was noted in these animals.

Naturally occurring infections of the mammary gland via the

Table 2. *A comparison of the present data on milk composition with that for chronic bacterial mastitis (4)*

	Bacterial mastitis	*Q fever infection*	*Injected with normal chick yolk sac only*
NCN	+	+	+
Casein	−	−	−
Chloride	+	+	+
Lactose	−	−	−
Fat	−	+	±
pH	+	+	+
Nonfat solids	−	+	±
Ash	−	?	?
Milk volume	−	−	−
Total N	--------	+	+
Water	--------	−	−

NOTE: A "plus" sign indicates increase in concentration; a "minus" indicates a decrease in concentration.

lacteal duct might be expected to produce less disturbance than was seen in these animals. The inocula in such cases would probably consist of a much smaller number of organisms and would be accompanied by much less foreign protein, which presumably caused the intense inflammatory reaction noted initially in both the control and the experimental animals. Since this experiment was performed, other data which suggest that naturally occurring mammary gland infections are of hematogenous origin have been published (*5*).

Conclusions

1. The injection of infectious suspensions of *C. burnetii* in the udders of cows resulted in the following changes in the composition of their milk: increases in total nitrogen, noncasein nitrogen, chloride, butterfat, nonfat solids, and pH; decreases in casein, lactose, milk volume, and water. No change in blood hemoglobin resulted.
2. Major fluctuations in these constituents disappeared within 8 days following injection.
3. Similar changes occurred in control animals injected with chick yolk-sac suspension, but the changes were of smaller magnitude and disappeared more quickly.
4. The changes are different from those that occur with chronic bacterial mastitis in that the butterfat and nonfat solids increased in concentration.

ACKNOWLEDGMENT

The data on rickettsiae in the milk of the infected cows were obtained by Drs. H. G. Stoenner and E. J. Bell, and will be presented in detail in a future publication. It is a pleasure to acknowledge also the technical assistance of George Tallent.

REFERENCES

(*1*) Stoenner, H. G., Bell, E. J., Lackman, D. B., Kissling, R., and Parker, R. R.: Symptomatology and pathology of experimental Q fever in dairy cattle. To be published.
(*2*) Goss, E. F., and Rudnick, A. W.: Testing milk and its products. Iowa State College Agricultural Extension Service Circular No. 219, 1943.
(*3*) Folin, O, and Wu, H.: A system of blood analysis. Supplement I. A simplified and improved method for determination of sugar. J. Biol. Chem. 41: 367–374 (1920).
(*4*) Little, R. B., and Plastridge, W. N.: Bovine Mastitis. McGraw-Hill, New York, 1946, p. 440.
(*5*) Stoenner, H. G.: Experimental Q fever in cattle—epizootiologic aspects. J. Am. Vet. Med. Assoc. 888: 170–174 (1951).

Changes Induced in the Flagellar Antigens of *Salmonella rostock* and *Salmonella california*

By O. A. PESO and P. R. EDWARDS*

Several instances of induced type transformation in the genus *Salmonella* have been reported. The first such report was that of Edwards, Moran, and Bruner (*1*) in which the intertransformability of *Salmonella simsbury* and *Salmonella senftenberg* was described. Bruner and Edwards (*2*) induced changes in the nonspecific phases of certain types. Bruner (*3*) was able to transform *Salmonella oranienburg* into a form indistinguishable from *Salmonella montevideo*. All of these changes in H antigens were brought about by cultivation of the organisms in semisolid agar to which had been added appropriate agglutinating serum in amount sufficient to immobilize the bacteria inoculated. Antigenic change was indicated by the migration of the bacteria through the medium after one or more transfers.

The present paper deals with changes produced in organisms which possess antigen g of the Kauffmann-White schema, i. e., forms which possess flagellar antigens related to *Salmonella enteritidis*. The methods used were similar to those described in the references cited above. The first change to be described was the transformation of *Salmonella rostock* (IX, XII: g, p, u) into a form indistinguishable from *Salmonella dublin* (IX, XII: g, p). Growth from a single colony of Kauffmann's standard culture of *S. rostock* was inoculated into the semisolid medium of Edwards and Bruner (*4*) to which had been added serum for antigen u of *S. rostock* in a final dilution of 1 to 100. The u serum was produced by absorption of *S. rostock* serum by *S. dublin*. The serum was sterilized by addition of an excess of chloroform. After eight transfers at intervals of 3 days, filmy bulbs extending from the line of inoculation appeared. Upon prolonged incubation, these bulbs gradually spread through the medium. From the spreading growth a form was isolated which was serologically indistinguishable from *S. dublin*. While the induced form retained the biochemical reactions of *S. rostock*, it no longer was agglutinated by factor u serum and it removed all agglutinins from *S. dublin* serum.

The second change to be described was produced in *Salmonella california* (IV, XII: g, m, t). Progeny of a single colony of the original strain of this type was cultivated in semisolid agar which contained *Salmonella oranienburg* (VI, VII: m, t) serum which had been absorbed

*From the Direccion Principal de Laboratorios, O. S. N., Buenos Aires, Argentina, and the Communicable Disease Center, Atlanta, Ga., respectively.

by *Salmonella montevideo* (VI, VII: g, m, s). This serum contained agglutinins for factor t, which is the major antigen of *S. california*. After four transfers, filmy bulbs extending from the line of inoculation were noted. Further transfers yielded a spreading growth from which was isolated an induced phase closely related to *Salmonella essen*. The agglutinative reactions of *S. essen*, *S. california*, and the induced phase are given in the table.

Agglutinative properties of induced variant of S. california

Antigens	Serums					
	Derby (f, g)	Enteritidis (g, m)	Oranienburg (m, t)	Enteritidis absorbed with california (induced phase)	m [1]	t [2]
California (original)	80	80	5,000	<20	±	+++
Essen	2,500	20,000	320	5,000	+	−
California (induced phase)	2,500	10,000	80	<20	+++	−
Enteritidis	2,500	20,000	640	5,000	+	−

[1] *S. oranienburg* antiserum absorbed with *S. berta*+*S. senftenberg*.
[2] *S. oranienburg* antiserum absorbed with *S. montevideo*.

In the transformation of *S. rostock* to a form serologically identical with *S. dublin*, only loss variation is involved. In this instance the observed changes coincide with the theory of White (*5*) that *Salmonella* types arise by loss variation. On the contrary, the change of *S. california* to a form resembling *S. essen* involved a gain of certain antigenic characters as well as a loss of others. The induced form no longer contained demonstrable t antigen, the major component of the parent form. This loss of t antigen was accompanied by a distinct gain in g and m components which exist only in minimal amount in the parent culture of *S. california*. While the induced form was not identical with *S. essen* as shown by agglutinin absorption, nevertheless, by the usual methods employed in the typing of *Salmonella* cultures, the induced form would be identified as *S. essen* to which it is closely related.

The above experiments offer further evidence that it is possible to transform *Salmonella* types by induced variation and indicate probable phylogenetic relationships of the types involved.

Summary

By induced variation, *S. rostock* was converted into a form serologically indistinguishable from *S. dublin*. Likewise, *S. california* was changed to a form closely related to, but not identical with, *S. essen*.

ACKNOWLEDGMENT

The senior author, a recipient of a Guggenheim fellowship during the course of this work, expresses his indebtedness to the Guggenheim Foundation.

REFERENCES

(*1*) Edwards, P. R., Moran, A. B., and Bruner, D. W.: Intertransformability of *Salmonella simsbury* and *Salmonella senftenberg*. Proc. Soc. Exper. Biol. and Med. **66**: 230 (1947).
(*2*) Bruner, D. W., and Edwards, P. R.: Changes induced in the nonspecific antigens of *Salmonella*. J. Bact. **55**: 359 (1948).
(*3*) Bruner, D. W.: The transformation of *Salmonella oranienburg* to *Salmonella montevideo*. J. Bact. **57**: 387 (1949).
(*4*) Edwards, P. R., and Bruner, D. W.: Serological identification of *Salmonella* cultures. Kentucky Agricultural Experiment Station Circular No. 54, 1942.
(*5*) White, P.: Further studies of the *Salmonella* group. Med. Research Council (Brit.), Special Report Series, No. 103, 1926.

Public Health Service Publications

January–June 1951

This list is issued to provide a complete and continuing record of Public Health Service publications for reference use by librarians, scientists, researchers, and others interested in public health work, and not to offer the publications for indiscriminate free distribution.

Single sample copies of most of the publications listed are available from the Public Inquiries Branch, Division of Public Health Methods, Public Health Service, Washington 25, D. C.

For quantities of any of these publications, except the statistical reports of the National Office of Vital Statistics, order from the Government Printing Office, where they are available at the prices shown, with a 25 percent reduction on orders of 100 or more copies of any single publication. The statistical reports of the National Office of Vital Statistics can be obtained only by writing to the National Office of Vital Statistics, Public Health Service, Washington 25, D. C.

PERIODICALS

Public Health Reports (weekly), January-June, vol. 66, Nos. 1–26, pages 1 to 850. 15 cents a copy.

Extracts from Public Health Reports (monthly), January-June, Tuberculosis Control Issues Nos. 59–64. Average 28 pages each. 10 cents a copy.

The Journal of Venereal Disease Information (monthly), January-June, vol. 32, Nos. 1–6. Pages 1 to 175. 15 cents a copy.

Journal of the National Cancer Institute (bimonthly), February-June, vol. 11, Nos. 4–6, pages 663 to 1324. $1.50 a copy. Subscription price $8 a year (available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.).

Public Health Engineering Abstracts (monthly), January-June, vol. XXXI, Nos. 1–6. Approximately 30 pages each. No sales stock.

Industrial Hygiene Newsletter (monthly), January-June, vol. 11, Nos. 1–6, 16 pages each. 10 cents a copy. (The name of this periodical was changed to Industrial Health Monthly beginning April 1951).

CDC Bulletin (monthly), January-June, vol. X, Nos. 1–6. No sales stock.

NONPERIODIC PUBLICATIONS

Librarians, Please Note

Nearly all publications on this list carry the designation "Public Health Service Publication No.—." This does not represent a new series, but is a registration system adopted late in 1950 as an internal housekeeping measure. Under the numbering plan, all nonperiodic issuances carry this designation, which is assigned consecutively at the time of going to press. Publications issued prior to adoption of

the numbering plan do not carry this designation and will not be incorporated into the system unless they are reissued.

The following series have been discontinued:

Supplements to Public Health Reports—last issued: No. 213 (1950).

Supplements to Journal of Venereal Disease Information—last issued: No. 23 (1949).

National Institutes of Health Bulletins—last issued: No. 193 (in press).

Public Health Bulletins—last issued: No. 306 (1949). (A bulletin on rural health cooperatives, jointly prepared by the Farm Credit Administration and the Public Health Service which was published by the Farm Credit Administration, was erroneously identified as Public Health Bulletin No. 308.)

Venereal Disease Bulletins—last issued: No. 100 (1949).

Series to Continue. Publications with a subject and field homogeneity will continue to be issued in series. In addition to the registration number given them under the over-all numbering system, they will carry the conventional series notation long familiar to librarians. Publications issued as part of a series are shown first on this list.

Missing Numbers. Under the new numbering system, publications are assigned registration numbers at the time they go to the printer. Variations in printing schedules result in publications being released out of the consecutive order of the Public Health Service Publications number, and some will be temporarily missing. One publication (No. 36), prepared for in-service use and not for general distribution, was inadvertently numbered. No. 36, therefore, will be permanently missing from library files.

PUBLIC HEALTH BIBLIOGRAPHY SERIES

1. Chronic illness. Digests of selected references. By Violet B. Turner. 1951. 216 pages. 50 cents. (PHS Publication No. 10.)
3. Small plant health programs—a bibliography. Compiled and annotated by Walter J. Lear. January 1951. 26 pages. Out of print. (PHS Publication No. 80.)

CANCER MORBIDITY SERIES

2. Cancer illness among residents of San Francisco and Alameda Counties, California, 1947. By William Grodowitz. 1951. 46 pages. No sales stock. (PHS Publication No. 65.)
3. Cancer illness among residents of New Orleans, Louisiana, 1947. By Irving I. Warran. 1951. 52 pages. No sales stock. (PHS Publication No. 67.)

HEALTH INFORMATION SERIES

29. The common cold. Revised 1951. 6-page folder. 5 cents; $1.50 per 100. (PHS Publication No. 106.)
37. Diphtheria. Revised January 1951. 6-page folder. 5 cents; $1.50 per 100. (PHS Publication No. 60.)
58. Gallstones. Revised 1951. 4 pages. 5 cents; $1.00 per 100. (PHS Publication No. 99.)

WATER POLLUTION SERIES

1. Water pollution in the United States. A report on the polluted condition of our waters and what is needed to restore their quality. 1951. 44 pages, illustrated. 35 cents. (PHS Publication No. 64.)
2. Tennessee River Drainage Basin. A cooperative State-Federal report on water pollution. 1951. 121 pages. Limited distribution. No sales stock.
3. Missouri River Drainage Basin. A cooperative State-Federal report on water pollution. 1951. 212 pages. Limited distribution. No sales stock.
4. Great Basin Drainage Basin. A cooperative State-Federal report on water pollution. 1951. 67 pages. Limited distribution. No sales stock.
5. California Drainage Basins. A cooperative State-Federal report on water pollution. 1951. 90 pages. Limited distribution. No sales stock.
6. Pacific Northwest Drainage Basins. A cooperative State-Federal report on water pollution. 1951. 79 pages. Limited distribution. No sales stock.
7. New England Drainage Basins. A cooperative State-Federal report on water pollution. 1951. 148 pages. Limited distribution. No sales stock.
8. Western Gulf Drainage Basin. A cooperative State-Federal report on water pollution. 1951. 67 pages. Limited distribution. No sales stock.

NATIONAL INSTITUTES OF HEALTH BULLETINS

193. Contamination of natural waters and mud with *Pasteurella tularensis* and tularemia in beavers and muskrats in the Northwestern United States. By R. R. Parker, Edward A. Steinhaus, Glen M. Kohls, and William L. Jellison. 1951. 61 pages. 45 cents.

180. Manual for the microscopical diagnosis of malaria in man. By Aimee Wilcox. Second edition, revised. 1950. 49 pages; 16 plates. 65 cents.

ANNUAL REPORT

Annual report of the Federal Security Agency, 1950. Public Health Service. 1951. 73 pages. 25 cents.

POSTER

Public Health Service Poster No. 2. Careers in mental health. 1951. No sales stock. (To accompany booklet Mental Health Series No. 5, Careers in mental health.)

OTHER PUBLICATIONS

Adequate financial support for hospital maintenance and operation. By Louis Block, David H. Spanier, and John V. Berberich, Jr. 1951. 27 pages. No sales stock. (PHS Publication No. 76.)

A draft act governing hospitalization of the mentally ill. 1951. 34 pages. No sales stock. (PHS Publication No. 51.)

Better health for 5 to 14 cents a year through fluoridated water. 1951. 24 pages, illustrated. 15 cents. (PHS Publication No. 62.)

Biological products. Establishments licensed for the preparation and sale of viruses, serums, toxins and analogous products, and the trivalent organic arsenic compounds. Revised February 5, 1951. 25 pages. Restricted free distribution. 10 cents. (PHS Publication No. 50.) (Supersedes Miscellaneous Publication No. 39, issued January 3, 1949.)

Breast self-examination. 1951. 8-page folder, illustrated. 10 cents; $5 per 100. (PHS Publication No. 48.)

Directory of full-time local health units, 1951. 1951. 55 pages. 20 cents. (PHS Publication No. 118.)

Directory of State and Territorial health authorities, 1951. 1951. 61 pages. 20 cents. (PHS Publication No. 75.)

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Directory of venereal disease clinics. Revised 1950. 1951. 157 pages. 65 cents. (PHS Publication No. 57.)

Drink away tomorrow's tooth decay. 1951. 6-page folder. 5 cents; 75 cents per 100. (PHS Publication No. 72.)

Electrokymography—proceedings of the first conference, 1950. 1951. 215 pages. 75 cents. (PHS Publication No. 59.)

Environment and health. Problems of environmental health in the United States and the Public Health Service programs which aid States and communities in their efforts to solve such problems. 1951. 152 pages, illustrated. 75 cents. (PHS Publication No. 84.)

Fluoridation of public water supplies. By F. J. Maier. 1951. 13 pages. No sales stock.

Handbook on sanitation of dining cars in operation. Standards of sanitation for operation and maintenance of food and drink service facilities on railroad passenger cars. 1951. 14 pages, illustrated. 20 cents. (PHS Publication No. 83.)

Handbook on sanitation of railroad passenger car construction. Standards of sanitation applicable to the construction of railroad passenger and dining cars. 1951. 15 pages, illustrated. 15 cents. (PHS Publication No. 95.)

Handbook on sanitation of railroad servicing areas. Design and operation of sanitation facilities for servicing railroad passenger cars. 1951. 28 pages, illustrated. 20 cents. (PHS Publication No. 66.)

Handbook on sanitation of vessels in operation. Sanitation features and facilities on vessels in operation. 1951. 44 pages, illustrated. 25 cents. (PHS Publication No. 68.)

Medical group practice in the United States. A summary of recent published material and supplementary unpublished data on fees and volume of work. By G. Halsey Hunt and Marcus S. Goldstein. 1951. 70 pages. 25 cents. (PHS Publication No. 77.)

Medical school grants and finances. Part I. Conclusions and recommendations. 1951. 48 pages. 20 cents. (PHS Publication No. 53.)

Medical school grants and finances. Part II. Financial status and needs of medical schools. 1951. 85 pages. 30 cents. (PHS Publication No. 54.)

Medical school grants and finances. Part III. Public Health Service grants, their distribution and impact on medical schools. 1951. 58 pages. 20 cents. (PHS Publication No. 55.)

National Institutes of Health. 1951. 22 pages, illustrated. No sales stock. (PHS Publication No. 81.)

Ordinance and code regulating eating and drinking establishments. 1943 recommendations of the Public Health Service. 1950. 60 pages. 25 cents. (PHS Publication No. 37.) (Formerly Public Health Bulletin No. 280.)

Patients in mental institutions, 1948. 1951. 119 pages. 55 cents. (PHS Publication No. 89.)

Proceedings of the first conference on cancer diagnostic tests, 1950. 1951. 91 pages. 30 cents. (PHS Publication No. 96.)

Proceedings of the first research conference on psychosurgery. 1951. 173 pages. $1. (PHS Publication No. 16.)

Public health areas and hospital facilities, a plan for coordination. By Joseph W. Mountin and Clifford H. Greve. 1950. 119 pages. 60 cents. (PHS Publication No. 42.)

Research grants awarded by the Public Health Service, 1950. By Ernest M. Allen. 1951. 59 pages. No sales stock. (PHS Publication No. 63.)

Salt and soda for shock in burns. 1951. 8-page folder. 5 cents; $2 per 100. (PHS Publication No. 43.)

Septic tank care. 1951. 6-page folder. 5 cents; $1.50 per 100. (PHS Publication No. 73.)

The national venereal disease control program. 1951. 12 pages, illustrated. 10 cents. (PHS Publication No. 56.) (This publication replaces Venereal Disease Bulletin 99.)

The scientist in the U. S. Public Health Service. 1951. 23 pages, illustrated. 25 cents. (PHS Publication No. 41.)

Water pollution control. Excerpts from "A Water Policy for the American People," the report of the President's Water Resources Policy Commission, 1950. January 1951. 29 pages. No sales stock. (PHS Publication No. 58.)

You'll want to know about your hospital program. Revised May 1951. 2-page folder. 5 cents; $1.50 per 100. (PHS Publication No. 8.)

REPRINTS FROM PUBLIC HEALTH REPORTS

3063. Dried smallpox vaccine. By J. W. Hornibrook and W. H. Gebhard. January 12, 1951. 6 pages; 1 illustration. 5 cents.
3064. Statistical studies of heart disease. VIII. Mortality from heart disease among Negroes as compared with white persons. By Maryland Y. Pennell and Josephine L. Lehmann. January 19, 1951. 24 pages. 10 cents.
3065. Accuracy of supplemental medical information on birth certificates. By A. M. Lilienfeld, E. Parkhurst, R. Patton, and E. R. Schlesinger. February 16, 1951. 8 pages. 5 cents.
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233. Effects of ionizing radiations on a transplanted lymphosarcoma. By Joanne Hollcroft, Egon Lorenz, and Harriet Hunstiger. August 1950. 16 pages.

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234. Host and extraneous factors in heterologous tumor transplantation. By E. J. Eichwald, H. Chan, M. Landa, and R. G. Evans. August 1950. 15 pages; 1 illustration.
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241. Complement fixation in animal neoplasia. I. A study of techniques for measurement of the reaction in rabbit serum with special reference to the temperature of inactivation. By Helen Thornton, L. D. Ellerbrook, M. C. Rhees, E. C. Stowell, Jr., and S. W. Lippincott. August 1950. 28 pages.
242. Influence of ovarian function on incidence of radiation-induced ovarian tumors in mice. By Henry S. Kaplan. August 1950. 8 pages.
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251. The relation of the lethal yellow (A^y) gene to pulmonary tumor formation and obesity in an inbred strain of mice. By Walter C. Morgan. October 1950. 6 pages.

252. Comparative stability of the agent of chicken tumor I in citrate and phosphate buffers at 37° C. By W. Ray Bryan, Mary E. Maver, John B. Moloney, Marguerite T. Wood, and Carl L. White, with an appendix by Jerome Cornfield. October 1950. 9 pages.
253. Action of bacterial toxins on tumors. VIII. Factors in their use for cancer therapy. By Paul A. Zahl. October 1950. 10 pages.
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271. Studies on the occurrence of spontaneous hepatomas in mice of strains C3H and CBA. By Howard B. Andervont. December 1950. 12 pages.
272. Transparent-chamber observations of the response of a transplantable mouse mammary tumor to local roentgen irradiation. By Ruth Merwin, Glenn H. Algire, and Henry S. Kaplan. December 1950. 31 pages; 7 illustrations.
273. Preliminary report of Conference on Geographical Pathology and Demography of Cancer held by Council for the Co-ordination of International Congresses of Medical Sciences, under the Auspices of World Health Organization (WHO) and United Nations Educational, Scientific, and Cultural Organization (UNESCO). Sessions held at Regent's Park College, Oxford, England, July 28 to August 4, 1950. December 1950. 36 pages.
274. A sex difference in the kidney glucuronidase activity of inbred mice. By Andrew G. Morrow, Dorothy M. Carroll, and Ezra M. Greenspan. February 1951. 7 pages.
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290. Studies on the blood supply of tumors in man. I. Fluorescence of cutaneous lesions. By Howard R. Bierman, Keith H. Kelly, Kenneth S. Dod, and Ralph L. Byron, Jr. April 1951. 13 pages; 2 illustrations.

291. Studies on the blood supply of tumors in man. II. Intra-arterial nitrogen mustard therapy of cutaneous lesions. By Howard R. Bierman, Keith H. Kelly, Ralph L. Byron, Jr., Kenneth S. Dod, and Michael B. Shimkin. April 1951. 15 pages; 4 illustrations.

292. The preparation and handling of replicate tissue cultures for quantitative studies. By Virginia J. Evans, Wilton R. Earle, Katherine K. Sanford, John E. Shannon, and Helen K. Waltz. April 1951. 21 pages; 1 illustration.

293. Biological activity of the agent of chicken tumor I (Rous) in citrate buffers of various molar concentrations. By W. Ray Bryan, Mary E. Maver, John B. Moloney, Dorothy Calnan, Carl L. White, and Marguerite T. Wood. April 1951. 9 pages.

294. Nucleolar volume changes in the mouse pancreas after repeated pilocarpine injections. By Hisako O. Yokoyama and Robert E. Stowell. April 1951. 7 pages; 1 illustration.

295. Mammary-tumor incidence in female C3Hb mice following long-continued gamma irradiation. By Egon Lorenz, Allen B. Eschenbrenner, Walter E. Heston, and Delta Uphoff. April 1951. 19 pages; 2 illustrations.

296. Irradiation of the normal human hypophysis in malignancy: Report of three cases receiving 8,100–10,000 r tissue dose to the pituitary gland. By Keith H. Kelly, Eggert T. Feldsted, Reynold F. Brown, Paul Ortega, Howard R. Bierman, Bertram V. A. Low-Beer, and Michael B. Shimkin. April 1951. 17 pages; 4 illustrations.

297. Production of tumors by methylcholanthrene and fetal skin transplanted to different sites in mice. By Michael Klein. April 1951. 11 pages; 3 illustrations.

298. The effect of injections of tumor fractions on liver catalase activity of mice. By Robert E. Greenfield and Alton Meister. April 1951. 9 pages.

299. Differential effects of roentgen rays on cell permeability and on cell cleavage. Experiments with egg cells of *Arbacia punctulata*. By Balduin Lucké, Renato A. Ricca, and Arthur K. Parpart. April 1951. 17 pages; 1 illustration.

300. The spontaneous biopsy. By George Adams. April 1951. 11 pages; 1 illustration.

301. Effects of a filtrable, self-propagating contaminant on a transplantable

acute lymphoid leukemia in mice. By L. W. Law and Thelma B. Dunn April 1951. 19 pages; 3 illustrations.

302. Tumor development in susceptible strain A and resistant strain L lung transplants in LA F_1 hosts. By W. E. Heston and Thelma B. Dunn. April 1951. 15 pages; 3 illustrations.

303. The effect of supplementary choline on the livers of rats fed p-dimethylaminoazobenzene. By Helen M. Dyer. April 1951. 8 pages.

REPRINTS FROM THE JOURNAL OF VENEREAL DISEASE INFORMATION

419. A study of the filter paper microscopic (FPM) test for syphilis. Preliminary report. By Ad Harris and Sidney Olansky. January 1951. 4 pages. 5 cents.

420. High potency of a penicillin G in experimental syphilis. By R. C. Arnold and James D. Thayer. January 1951. 2 pages. 5 cents.

421. Dehydrogenations produced by the Reiter spirochete. By Matthew A. Bucca, James D. Thayer, Harriett B. Roberts, and Bernard Tager. January 1951. 8 pages. 5 cents.

422. Results of diagnostic procedures in evaluation of serodiagnostic methods, 1950. February 1951. 8 pages. 5 cents.

423. Syphilis among the Navaho Indians. By Charles S. McCammon, Frank J. Dufner, and Francis W. Felsman. February 1951. 6 pages. 5 cents.

424. Results of penicillin therapy for neurosyphilis at Bellevue Hospital. By Bernard Dattner, Evan W. Thomas, and Lopo de Mello. February 1951. 6 pages. 5 cents.

425. Penicillin levels in spinal fluid after intramuscular injection of procaine penicillin. By R. D. Wright, J. D. Thayer, F. P. Nicholson, and R. C. Arnold. February 1951. 4 pages. 5 cents.

426. The effect of syphilis on nonwhite longevity as reflected in mortality data, Georgia, 1939–41. By Harry W. Martin. March 1951. 4 pages. 5 cents.

427. Venereal disease case finding in high-prevalence areas. I. Procedures used. By Gustav Gumpert, Norman R. Ingraham, Jr., and Michael J. Burke. March 1951. 10 pages, illustrated. 5 cents.

428. Dental hypoplasias in relation to congenital syphilis. By S. B. Beecher, H. N. McIntosh, and E. J. McCart. March 1951. 2 pages. 5 cents.

429. Reinfections following routine metal therapy of early syphilis. By Evan W. Thomas and Simeon Landy. April 1951. 4 pages. 5 cents.

430. Cisternal puncture for examination of cerebrospinal fluid. By Howard L. Cecil and Edgar B. Johnwick. April 1951. 5 pages. 5 cents.

431. A new approach to venereal disease education at Michigan fairs. By John A. Cowan. April 1951. 4 pages. 5 cents.

432. Control serum in the serodiagnosis of syphilis with special reference to its use in standardizing Kahn antigens. By M. B. Kurtz and E. M. Hill. April 1951. 3 pages. 5 cents.

433. A comparison of two methods of gland transfer in experimental syphilis. By Charlotte P. McLeod and R. C. Arnold. April 1951. 4 pages. 5 cents.

434. Terramycin in treatment of granuloma inguinale. By Robert B. Greenblatt, Wm. E. Barfield, Robert B. Dienst, and Robert M. West. May 1951. 4 pages. 5 cents.

435. Local cortisone acetate therapy in congenital syphilitic interstitial keratitis. A preliminary report. By W. G. Simpson, B. F. Rosenblum, C. E. Wood, and E. L. Stammer. May 1951. 4 pages. 5 cents.

436. Relative effectiveness of penicillin therapy in early and latent syphilis in rabbits. By R. C. Arnold and Charlotte P. McLeod. May 1951. 4 pages. 5 cents.

437. Case finding of early syphilis by the public health nurse. By A. C. Bulla, Flora Wakefield, and M. Estelle Hunt. May 1951. 8 pages. 5 cents.

438. Case finding through an understanding of known syphilitic patients. By A. L. Gray, Theodore J. Bauer, Lida J. Usilton, and R. O. Carlson. 6 pages. 5 cents.

439. Syphilis case finding through education. By John W. Morse and Albert P. Iskrant. June 1951. 8 pages. 5 cents.

440. Syphilis prevalence and community structure. By W. Lloyd Warner, Mozell C. Hill, C. D. Bowdoin, J. Wallace Rion, and Bevode McCall. June 1951. 10 pages. 5 cents.

NATIONAL OFFICE OF VITAL STATISTICS PUBLICATIONS*

International Recommendations on Definitions of Live Birth and Fetal Death, 1950. 11 pages. 5 cents. (PHS Publication No. 39.)

The First Annual Report of the United States National Committee on Vital and Health Statistics, 1950. 23 pages. 15 cents. (PHS Publication No. 40.)

Current Mortality Analysis (monthly), vol. 8, Nos. 10–12, 1950. Vol. 9, Nos. 1–3, 1951.

Monthly Marriage Report (marriage licenses issued in major cities), vol. 4, Nos. 11–13, 1950; vol. 5, Nos. 1–4, 1951.

Weekly Mortality Index, vol. 21, Nos. 52–53, 1950; vol. 22, Nos. 1–25, 1951.

Weekly Morbidity Report, vol. 1, Nos. 51–52, 1950; vol. 2, Nos. 1–25, 1951.

Communicable Disease Summary, weeks ending January 6, 1951–June 30, 1951.

Vital Statistics—Special Reports, Vol. 33, Selected Studies

No. 9. Estimated average length of life in the death-registration States. 163–170 pages.

Vital Statistics—Special Reports, Vol. 36, National Summaries

No. 1. Summary of natality statistics, United States, 1949. 1–10 pages.

No. 2. Summary of marriage and divorce statistics, United States, 1949 11–26 pages.

No. 3 Marriages, United States, each State and county, 1949. 27–50 pages.

No. 4. Births by race and by urban and rural areas, United States, each division and State, 1949. 51–60 pages.

*Available only from the National Office of Vital Statistics, Public Health Service, Washington 25, D. C.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

Announcement

A New *Morbidity and Mortality Weekly Report*

The new monthly PUBLIC HEALTH REPORTS (see back cover) will publish from time to time, as appropriate, reports, tabulations, and articles dealing with morbidity statistics, both domestic and foreign. The present weekly "Incidence of Disease" section, however, will be discontinued as of December 31, 1951.

Current provisional morbidity data on notifiable diseases for the United States now appear in summary form and in tabulations by States and cities in the *Weekly Morbidity Report* issued by the National Office of Vital Statistics of the Public Health Service. Beginning on January 11, 1952, the Public Health Service through the National Office of Vital Statistics will issue a *Morbidity and Mortality Weekly Report* presenting these morbidity data as well as certain mortality data for selected cities.

Libraries and agencies that have depended upon PUBLIC HEALTH REPORTS for current morbidity statistics for the United States may continue to receive the same data by writing to the National Office of Vital Statistics, Public Health Service, Washington 25, D. C., requesting that they be placed on the mailing list for the new *Morbidity and Mortality Weekly Report.* Individuals who wish to be placed on the mailing list should indicate how and to what extent they will make use of this publication.

Since the *Weekly Epidemiological Record* and other publications of the World Health Organization, Geneva, Switzerland, contain morbidity data for foreign countries, tabulations of notifiable diseases occurring outside the United States and its Territories will not appear regularly in National Office of Vital Statistics publications.

UNITED STATES

Reports From States for Week Ended December 1, 1951

The number of reported cases of measles increased from 3.401 for last week to 5,138 for the current week. Incidence increased in all sections of the country except in the West South Central, Mountain, and Pacific States. In 1950 the Mountain States was the only group in which a relatively high incidence rate was reported. The reported case rates show wide variations in the various parts of the country which probably are the result of differences in completeness of reporting. Thus, the relatively high rates of incidence which are common in epidemic years in the New England, Middle Atlantic, East North

Central, Mountain, and Pacific States probably are a reflection of more complete reporting. In other areas, such as the West North Central, Middle Atlantic, and East South Central States, reporting of measles probably is much less complete even in epidemic years when compared with the former group.

The incidence of diphtheria for the current week was 20 percent under that for the same week last year. The usual seasonal rise has not been evident in any part of the country except in the southern States.

The number of cases of meningococcal meningitis for the current week (84) is well above that for the same week last year (60) and the 5-year median (60). Since the seasonal low week early in September, 728 cases have been reported as compared with 661 for the same period last year.

A total of 29 cases of malaria in civilians was reported, 21 of which were in Wisconsin. A total of 117 cases in military establishments was reported. One military case in California, reported to have been infected in a southern State, is said to be a recurrent infection which has been treated since 1939.

One case of psittacosis was reported by Illinois, and two cases of smallpox were reported by Nebraska.

Epidemiological Reports

Serum hepatitis

Dr. C. R. Freeble, Ohio Department of Health, has reported an outbreak presumed to be homologus serum jaundice which has occurred in a State institution and was investigated in retrospect. From September 1950 through August 1951 there was a total of 13 cases of hepatitis admitted to the institution hospital, all having jaundice. Each patient had had a febrile illness which started with general malaise and, usually, abdominal pain. In most cases the liver was palpable and each had an elevated icteric index. The cases had their onsets as follows: September 1950, one case; February 1951, one case; May, one case; June, two cases; July and August, four cases each. The patients were scattered at random throughout the institution, and it was not possible to show any correlation between exposure to known cases and onset of illness. However, during February and March 1951, all inmates were subjected to routine blood typings by the finger puncture method. One spring lancet was used for all finger punctures, and was "sterilized" each time by dipping in isopropyl alcohol. The patients who had onsets of illness in June, July, and August remembered the month in which the puncture was done, and in all cases the illness fell within the general accepted incubation period for homologus serum jaundice. In September it was learned that a case of hepatitis occurred in a person who had been a patient

in another hospital where he had received a transfusion of blood on May 2. The blood donor was an inmate of the institution referred to above, but had not been recognized as a case of hepatitis.

Botulism

The food which was found to be implicated in the three fatal cases of botulism in Los Angeles, as reported last week, was home-canned greens, *Portulaca oleracea*. Type A toxin was demonstrated by animal inoculation.

Gastroenteritis

Dr. W. R. Giedt, Washington State Department of Health, has reported a small family outbreak of food intoxication in which commercially canned kippered herring was eaten. Bacteriological examination of the opened can showed it to contain hemolytic *Staphylococcus aureus*, but a specimen of another can of the same consignment was bacteriologically negative.

J. L. Rowland, Missouri Department of Public Health, has reported an outbreak of staphylococcus food poisoning which resulted from eating a cream-filled product known as "Long Johns." Of 40 persons known to have eaten this food, 34 became ill. On the day the cream filling was made, a few pastries were filled. The mix was refrigerated between fillings and overnight, but persons purchasing the pastry on the second day were more violently ill than those purchasing and eating the food on the first day.

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Dec. 1, 1951	Dec. 2, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	1	----	------	(1)	(1)	(1)	(1)	57	42	47
Diphtheria (055)	115	145	218	27th	1,820	2,441	4,298	3,828	5,569	8,909
Encephalitis, acute infectious (082)	33	18	5	(1)	(1)	(1)	(1)	973	933	603
Influenza (480–483)	581	848	974	30th	6,350	9,887	9,887	122,405	148,651	137,825
Measles (085)	5,138	2,515	2,277	35th	25,282	15,243	14,873	494,193	303,414	578,346
Meningitis, meningococcal (057.0)	84	60	60	37th	728	661	653	3,789	3,460	3,184
Pneumonia (490–493)	1,012	1,443	(2)	(1)	(1)	(1)	(1)	55,132	74,697	(2)
Poliomyelitis, acute (080)	428	597	433	11th	26,379	30,855	26,321	27,591	31,986	26,671
Rocky Mountain spotted fever (104)	----	----	------	(1)	(1)	(1)	(1)	328	451	555
Scarlet fever (050) [3]	1,276	1,158	1,551	32d	10,132	10,479	14,061	63,518	50,649	70,143
Smallpox (084)	2	4	1	35th	3	11	9	14	37	52
Tularemia (059)	13	23	23	(1)	(1)	(1)	(1)	593	825	899
Typhoid and paratyphoid fever (040, 041) [4]	52	51	51	11th	[5] 2,500	2,745	3,186	[5] 2,935	3,254	3,671
Whooping cough (056)	1,307	1,931	1,931	39th	9,784	14,997	14,997	63,559	112,192	91,503

[1] Not computed.
[2] Data not available.
[3] Including cases reported as streptococcal sore throat.
[4] Including cases reported as salmonellosis.
[5] Deduction: Arkansas, week ended Oct. 27, 1 case.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Dec. 1, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**115**	**33**	**581**	**5,138**	**84**	**1,012**	**428**
New England	**1**	**1**	**1**	**939**	**3**	**87**	**2**
Maine	----	----	1	161	----	28	----
New Hampshire	----	----	----	32	----	13	----
Vermont	----	----	----	87	----	----	1
Massachusetts	1	----	----	386	3	----	1
Rhode Island	----	----	----	93	----	4	----
Connecticut	----	1	----	180	----	42	----
Middle Atlantic	**14**	**11**	**8**	**2,042**	**13**	**95**	**35**
New York	8	11	(1)	888	6	----	19
New Jersey	1	----	8	422	2	33	2
Pennsylvania	5	----	----	732	5	62	14
East North Central	**9**	**3**	**4**	**708**	**12**	**78**	**50**
Ohio	5	----	----	176	4	----	13
Indiana	----	----	----	42	1	----	1
Illinois	----	2	3	242	6	62	16
Michigan	3	1	1	136	----	16	10
Wisconsin	1	----	----	112	1	----	10
West North Central	**8**	**2**	**9**	**281**	**8**	**78**	**42**
Minnesota	2	----	1	15	3	29	15
Iowa	----	----	----	2	1	----	----
Missouri	5	----	4	6	1	1	10
North Dakota	----	----	----	225	2	40	3
South Dakota	----	1	----	6	----	----	1
Nebraska	1	----	----	16	----	----	3
Kansas	----	1	4	11	1	8	10
South Atlantic	**44**	----	**31**	**491**	**10**	**145**	**25**
Delaware	----	----	----	----	----	----	----
Maryland	----	----	2	239	----	22	3
District of Columbia	----	----	----	20	----	18	----
Virginia	8	----	----	61	2	47	2
West Virginia	5	----	----	69	----	----	5
North Carolina	6	----	----	3	2	----	1
South Carolina	9	----	5	3	----	6	----
Georgia	11	----	24	82	5	52	10
Florida	5	----	----	14	1	----	4
East South Central	**23**	**2**	**1**	**264**	**6**	**54**	**31**
Kentucky	5	----	----	49	2	10	8
Tennessee	4	----	----	18	1	----	5
Alabama	10	1	----	185	1	25	5
Mississippi	4	1	1	12	2	19	13
West South Central	**15**	**3**	**169**	**46**	**17**	**343**	**75**
Arkansas	4	----	84	3	2	35	10
Louisiana	7	----	2	----	1	42	8
Oklahoma	1	1	83	1	9	14	11
Texas	3	2	----	42	5	252	46
Mountain	----	**1**	**255**	**190**	**4**	**57**	**39**
Montana	----	1	13	35	2	----	7
Idaho	----	----	----	10	----	----	----
Wyoming	----	----	----	23	----	2	3
Colorado	----	----	74	55	1	29	13
New Mexico	----	----	----	21	----	2	----
Arizona	----	----	168	4	1	24	----
Utah	----	----	----	41	----	----	15
Nevada	----	----	----	1	----	----	1
Pacific	**1**	**10**	**103**	**177**	**11**	**75**	**129**
Washington	----	----	71	51	3	6	16
Oregon	----	----	26	21	----	29	12
California	1	10	6	105	8	40	101
Alaska	----	----	----	----	----	----	----
Hawaii	----	----	172	599	----	2	----

[1] New York City only.
Anthrax: Arkansas, 1 case.
Psittacosis: Illinois, 1 case.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Dec. 1, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever[1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever[2] (040, 041)	Whooping cough (056)	Rabies in animals
United States		1,276	2	13	52	1,307	179
New England		84			3	127	
Maine		3				8	
New Hampshire		5				6	
Vermont					1	24	
Massachusetts		46			2	70	
Rhode Island		19					
Connecticut		11				19	
Middle Atlantic		229			3	244	36
New York		135				86	16
New Jersey		24				73	
Pennsylvania		70			3	85	20
East North Central		366		1	4	217	20
Ohio		108			2	25	5
Indiana		45				44	9
Illinois		55		1	1	25	4
Michigan		114				63	2
Wisconsin		44			1	60	
West North Central		54	2	2	3	36	30
Minnesota		21				1	23
Iowa		5				5	5
Missouri		11		2	1	15	2
North Dakota						1	
South Dakota		1				6	
Nebraska		2	2				
Kansas		14			2	8	
South Atlantic		171		4	10	144	27
Delaware		3				1	
Maryland		21		1	1	7	
District of Columbia		8					
Virginia		18				15	3
West Virginia		26				74	3
North Carolina		63		1		4	5
South Carolina		8		1	2	7	9
Georgia		15		1	5	30	7
Florida		9			2	6	
East South Central		69		1	1	108	29
Kentucky		18		1		53	12
Tennessee		41				17	6
Alabama		7				24	11
Mississippi		3			1	14	
West South Central		38		3	9	290	37
Arkansas		3			1	24	5
Louisiana		4				14	
Oklahoma		9			2	11	3
Texas		22		3	6	241	29
Mountain		41		2	4	53	
Montana		10				2	
Idaho		1			1	5	
Wyoming		1		2		1	
Colorado		3			1	15	
New Mexico		1			2	9	
Arizona		6				20	
Utah		13				1	
Nevada		6					
Pacific		224			15	88	
Washington		26				7	
Oregon		16			3	3	
California		182			12	78	
Alaska		5					
Hawaii		2			1		

[1] Including cases reported as streptococcal sore throat.
[2] Including cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Nov. 17, 1951

Disease	Total	New-found-land	Prince Edward Island	Nova Scotia	New-Bruns-wick	Que-bec	On-tario	Mani-toba	Sas-katch-ewan	Al-berta	Brit-ish Co-lum-bia
Brucellosis	1						1				
Chickenpox	1,071	1		43	1	161	448	59	57	156	145
Diphtheria	10					10					
Dysentery:											
Amebic	2					2					
Bacillary	1							1			
German measles	76			8		6	14		13	30	5
Influenza	30			24			2	2			2
Measles	807	3		50	6	134	32	21	12	287	262
Meningitis, meningococcal	7	1				1	2		1	2	
Mumps	413	3			1	71	225	33	6	21	53
Poliomyelitis	25			3		7	9	4			2
Scarlet fever	376	3			2	90	20	41	32	38	150
Tuberculosis (all forms)	162	1		2	7	65	32	16	9	12	18
Typhoid and paratyphoid fever	3					1	1			1	
Venereal diseases:											
Gonorrhea	288	4		13	6	78	54	35	19	30	49
Syphilis	67	4		5	4	28	7	2		7	10
Primary	6					3	2			1	
Secondary	3	1			2						
Other	58	3		5	2	25	5	2		6	10
Whooping cough	219	3				79	59	30	6	25	17

CUBA

Reported Cases of Certain Diseases—4 Weeks Ended Oct. 27, 1951

Disease	Total	Pinar del Rio	Habana		Matan-zas	Santa Clara	Cama-guey	Oriente
			Habana City	Total				
Cancer	113	6		17	13	31	27	19
Chickenpox	1			1				
Diphtheria	19	1	5	12	1	1		4
Leprosy	47			10	3	18	8	8
Malaria	81	1	1	1			2	77
Measles	10	3	4	5	1	1		
Poliomyelitis	1							1
Tuberculosis	206	2	1	1	13	131	47	12
Typhoid fever	43	6	11	12	1	11	6	7

NORWAY

Reported Cases of Certain Diseases—July 1951

Disease	Cases	Disease	Cases
Diphtheria	6	Pneumonia (all forms)	1,688
Dysentery, unspecified	2	Poliomyelitis	106
Encephalitis, infectious	2	Rheumatic fever	66
Erysipelas	300	Scabies	448
Gastroenteritis	3,818	Scarlet fever	71
Hepatitis, infectious	49	Tuberculosis (all forms)	232
Impetigo contagiosa	1,254	Typhoid fever	4
Influenza	1,329	Venereal diseases.	
Malaria	2	Gonorrhea	146
Measles	1,164	Syphilis	30
Meningitis, meningococcal	11	Other forms	3
Mumps	121	Whooping cough	1,395

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Cholera

Pakistan. The incidence of cholera in East Bengal Province rose from 52 cases for the week ended October 6 to 272 cases for the week ended October 27. In Dacca two cases were reported for the week ended November 24. The seaport of Chalna reported seven cases during the week ended November 17.

Smallpox

Indonesia. Two cases of smallpox were reported in Ambon, Ceram, for the week ended October 13. For the week ended November 17, smallpox was reported in Java as follows: Bandoeng, two cases; and Surabaya, nine.

Sudan, Anglo-Egyptian. An outbreak of smallpox has occurred in the Anglo-Egyptian Sudan. The number of cases reported for the week ended November 17 was 25 as compared with only 2 for the previous week.

Venezuela. During September, six cases of alastrin were reported.

Typhus Fever

Ceylon. One case of typhus fever was reported in the Western Province for the week ended September 22. This was the first case since June 24.

India. During the week ended November 24, two cases of typhus fever were reported in the seaport of Cochin.

Iraq. For the week ended November 24, four cases of typhus fever were reported. Of these, two were in Baghdad and one in Mosul.

Mexico. During the period October 28 to November 10, four cases of typhus fever were reported in Mexico City.

Yellow Fever

Gold Coast. During the period November 7–12, four cases of yellow fever were reported. Two cases were in African males, ages 8 and 27, at Akwatia. The other two cases were in the Oda District.

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The printing of this publication has been approved by the Director of the Bureau of the Budget (August 10, 1949).

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the Public Health Service through the Division of Public Health Methods, pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220.

It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 15 cents. Subscription price $4.75 a year; $6.25 foreign.

—Announcement—

PUBLIC HEALTH REPORTS

To be Published Monthly Next Year

Beginning in January 1952 PUBLIC HEALTH REPORTS will be published monthly. Two other technical publications of the Public Health Service—the Journal of Venereal Disease Information and the CDC Bulletin—are being merged with it.

The merger has come about as the result of an extended study of the Public Health Service's publishing activities. The new journal is designed to carry out more efficiently and economically the Public Health Service's responsibilities for disseminating scientific information on matters of health.

The new PUBLIC HEALTH REPORTS will be concerned with the technical and professional aspects of public health practice, with problems of health administration, and with research in these fields. It will include substantially the types of material that have been appearing in the three present journals and the monthly Tuberculosis Control Issue of PUBLIC HEALTH REPORTS. There will be more emphasis, however, on administrative practice, program development, and applied research aspects and less emphasis on bench research and clinical material not rather directly related to public health practice.

As has been true with each of the present journals, the pages of the new PUBLIC HEALTH REPORTS will be open, on merit, to any responsible author. General editorial guidance will be provided by a Board of Editors composed of individuals of recognized competence and professional stature drawn from both within and outside the Federal service.

Every effort will be made to furnish the new PUBLIC HEALTH REPORTS to representative organizations in public health and its related fields. Most of the readers on the mailing list are affiliated with organizations to which free distribution can legally be made. They will continue to receive the new journal either directly or through these organizations.

The first issue of the new PUBLIC HEALTH REPORTS and an application form for a free subscription will be sent to readers now on the free lists for technical periodicals. After they have had an opportunity to review the new PUBLIC HEALTH REPORTS and to consider its usefulness in their work, readers who wish to remain on the lists and receive the new periodical regularly should complete the application and send it in as soon as possible. This will allow time to revise the lists for mailing the second and subsequent issues.

The new PUBLIC HEALTH REPORTS will also be available by paid subscription from the Superintendent of Documents, Government Printing Office.

Public Health Reports

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Observations on Rat Ectoparasites and Typhus Fever in San Antonio, Texas

By David E. Davis*

Studies on the control of typhus fever conducted in San Antonio, Tex., found that rats containing complement-fixing antibodies for typhus fever were widely distributed in the city (*1*, *2*). DDT dust to reduce rat fleas was used and resulted in a reduction of human cases of typhus fever (*3*, *4*). Observations on rats and typhus fever (*5*) showed that 35 percent of the roof rats and 51 percent of the Norway rats contained typhus complement-fixing antibodies.

Observations on the ectoparasites are presented to make data available on abundance of ectoparasites in the southwestern portions of the area where typhus is endemic. The recent decline in typhus fever (*6*) makes a comparison possible of the data on fleas for the years 1944–45 of high typhus fever rates with data for recent years. These data apparently are the most extensive collected before the reduction in typhus began. Hill and Ingraham (*7*) presented data for the periods of high typhus rates for rural Alabama.

Observations on Fleas

Several species of fleas are found on rats in San Antonio. *Xenopsylla cheopis*, the Indian rat flea, is the most common species and is found wherever there are rats. *Leptopsylla segnis*, the so-called mouse flea, is regularly present and *Echidnophaga gallinacea*, the chicken flea, is common on rats caught in poultry houses and chicken coops. *Ctenocephalides* spp., the cat and dog fleas, are frequently found on rats, especially where cats or dogs are present. *Nosopsyllus fasciatus*, the northern rat flea, is rare. *Pulex irritans*, the human flea, is occasionally present.

Ctenocephalides sp. is the only flea in San Antonio which commonly becomes a pest to humans. This species is the cause of complaints

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that fleas are regularly found in houses and yards. One infestation of *P. irritans* in a shed was observed.

Changes in numbers of fleas found in relation to the seasonal occurrence of typhus fever are of interest. Throughout the southern United States, murine typhus is known to reach a maximum in the summer, shortly after the greatest abundance of rat fleas. For a study of seasonal changes in abundance of fleas in San Antonio, rats were collected systematically throughout the year. The rats were captured in number 0 steel traps, placed alive in a bag, and chloroformed in the laboratory. The rats were carefully combed to obtain all ectoparasites. The ectoparasites were identified under a binocular dissecting scope and then preserved in alcohol.

The rats were collected principally from the southern part of the city. The houses and stores are one-story frame structures. The stores are generally corner groceries. Rats caught in usual places (barns, for example) are not included. An attempt was made to have the sample of rats as comparable as possible from season to season. The collections are probably as random a sample as is practicable. Both Norway rats (*Rattus norvegicus*) and roof rats (*R. rattus*) are represented.

The rats are divided into adult and immature, according to reproductive state (*5*). The indices are calculated according to mean number of fleas per rat and to percent of rats infested as recommended (*8*). Indices are not recorded when less than five rats are in a category.

Table 1 shows that seasonal changes in abundance of *X. cheopis*

Table 1. *Seasonal changes in abundance of* Xenopsylla cheopis (*1944–45*)

	May-June			July-August			September-October			November-December		
	Rats	Mean[1]	Percent[2]	Rats	Mean	Percent	Rats	Mean	Percent	Rats	Mean	Percent
Roof rats:												
Adults	4	-------	-------	27	3.5	67	15	3.4	66	6	1.3	66
Immature	8	8.1	88	31	9.0	77	29	1.3	48	26	2.5	42
Norway rats:												
Adults	27	14.1	96	43	11.5	95	22	2.7	73	12	5.1	66
Immature	13	13.9	100	13	10.9	100	17	5.0	88	2	-------	-------
	December-January-February			March-April			May-June			July-August		
	Rats	Mean	Percent	Rats	Mean	Percent	Rats	Mean	Percent	Rats	Mean	Percent
Roof rats:												
Adults	53	0.7	34	62	1.3	69	22	3.2	59	19	7.2	68
Immature	58	.9	38	77	1.1	45	63	3.8	70	45	8.4	49
Norway rats:												
Adults	27	1.8	41	60	5.1	58	19	14.7	79	57	8.5	74
Immature	5	6.6	80	34	5.4	65	16	10.0	56	40	8.6	82

[1] Mean number of fleas per rat.
[2] Percent of rats with fleas.

Table 2. *Seasonal changes in abundance of* Leptopsylla segnis *(1944–45)*

	May-June			July-August			September-October			November-December		
	Rats	Mean[1]	Percent[2]	Rats	Mean	Per cent	Rats	Mean	Per cent	Rats	Mean	Per cent
Roof rats												
Adults	4			27	0	0	15	0	0	6	0.8	50
Immature	8	0	0	31	0	0	29	0	0	26	8	4
Norway Rats												
Adults	27	4.0	37	43	2	2	22	4	4	12	4	8
Immature	13	3.8	31	13	0	0	17	[illegible]	6	2		

	December-January-February			March-April			May-June			July-August		
	Rats	Mean	Percent	Rats	Mean	Per cent	Rats	Mean	Per cent	Rats	Mean	Percent
Roof rats												
Adults	53	1.2	37	52	2.6	75	22	0.4	18	19	0	0
Immature	58	1.5	36	77	2.2	45	63	4	27	45	0	0
Norway Rats												
Adults	27	2	18	60	7.1	63	19	9.0	47	57	0	0
Immature	5	1.2	20	34	9.4	65	16	6	37	40	0	0

[1] Mean number of fleas per rat.
[2] Percent of rats with fleas

reaches a peak from May to August and drops to a minimum in the winter. The indices are shown to be higher in July and August 1944, than for the same months in 1945.

Table 2 shows the seasonal changes in abundance for *L. segnis*. The maximum abundance occurs in May and June and the species is practically absent in July and August.

The chicken flea, *E. gallinacea*, was frequently found on rats at all seasons of the year, but no conclusions concerning seasonal abundance can be made from this study as no attempt was made to get monthly samples of rats from poultry houses or chicken coops

N. fasciatus was found in very small numbers (total of 25) most commonly in March and April. None was found in July and August

Ctenocephalides sp. was found regularly in suitable places. No conclusions as to seasonal abundance can be drawn from the collections on rats, but judging from the number of complaints to the health department of flea infestations in yards and houses, it seems that cat fleas are most common in May and June.

The human flea, *P. irritans*, is rare on rats. A total of eight was collected, mostly between April and July.

From these observations on fleas, it is clear that the maximum abundance occurs in May and June, but that, because of different peaks of abundance of two species, fleas are common in San Antonio for about 6 months.

For the comparison of abundance of ectoparasites, the rats were classified according to three types of establishments, residences, stores, (cafes, groceries, theaters, drug stores) and mills (grain and peanut

mills) in order to group the rats from similar habitats. The data show no consistent differences in the numbers of fleas on rats from different types of establishments (tables 1 and 2). These studies, however, were not planned to clarify this problem. Especially designed collections of rats from carefully selected establishments are required to determine if differences exist. It appeared true, however, that greater variation from rat to rat in the number of fleas was present in grain mills than elsewhere. Totals of over a hundred fleas on a rat are common in such places. The record of 423 fleas (mostly *L. segnis*) was obtained on a crippled rat caught in a peanut mill.

In addition to seasonal changes in abundance, other aspects may affect the role of fleas in typhus fever. The total fleas, according to species and sex of rat are shown in table 3 which includes all adult rats irrespective of season or place. It is at once clear that the Norway rat in the San Antonio area had more fleas than did the roof rat.

Table 3. *Total fleas on rats—San Antonio*

Species	Sex	Number rats	Arithmetic		Geometric		Percent with fleas
			Mean	Standard error	Mean	Standard error	
Norway	Male	147	11.84	1.46	4.93	0.051	85
	Female	138	9.79	1.19	3.66	.055	69
Roof	Male	95	4.68	.71	2.39	.060	76
	Female	117	2 69	.45	1.43	.045	65

The number of fleas (*X. cheopis*) found on rats caught outside buildings is known to be small. In this investigation few rats were caught outside of buildings, but in two places rats were living out in the grass and feeding in nearby sheds. Rats caught in these places did not have fleas. However, rats caught near the buildings in which they live had as many fleas as rats caught in the buildings.

It is of interest to compare the number of fleas found on male with those found on female rats. Table 3 presents the arithmetic means and their standard errors for all adult Norway rats and roof rats of each sex. In both cases the males had more fleas than did the females. However, the fact that the number of fleas observed are not in a normal distribution, and that the arithmetic mean is very much influenced by the occasional extreme values in these distributions, makes the mean hard to interpret. An alternative centering constant free of this difficulty is the geometric mean (table 3).

For roof rats the difference between the sexes is 2.99 times its standard error, and hence is considered significant. For Norway rats the difference between sexes is only 1.71 times the standard error of the difference, but the fact that the difference is in the same direction

as in roof rats lends support to the idea that male rats have significantly more fleas than do females in this situation.

The sex ratio of the fleas is of possible importance in the knowledge of the life history of the fleas. The ratios for *X. cheopis* and for *L. segnis* are given in table 4. Analysis of the sex ratios in different types of establishments (not presented here) give very similar results. The recent work of Cole (*9*) shows a correlation between the temperature and the sex ratio of fleas (*X. cheopis*) found on rats. On cold days there are more females than males and on warm days there are more males than females. The sexes were equally represented at about 75° F. in several towns in the southern United States. A seasonal calculation for San Antonio confirms this observation (table 5). The percent of female fleas on Norway rats in the warmer seasons was lower than that in the colder seasons. It is interesting to note that apparently the same temperature relation occurs in *L. segnis* which is collected only in the colder months and has a very small proportion of males (tables 4 and 5).

Table 4. *Sex ratio of* Xenopsylla cheopis

	Rats	Mean of male fleas per rat	Mean of female fleas per rat	Total fleas	Percent male fleas
Roof rats:					
Adults	104	1.9	2.5	457	43
Immature	175	2.7	3.3	1,049	43
Norway rats:					
Adults	208	5.7	5.4	2,301	51
Immature	137	5.2	4.2	1,386	51

Sex ratio of Leptopsylla segnis

	Rats	Mean of male fleas per rat	Mean of female fleas per rat	Total fleas	Percent male fleas
Roof rats:					
Adults	54	1.1	2.3	186	34
Immature	71	1.3	2.5	271	34
Norway rats:					
Adults	65	5.8	9.5	991	38
Immature	33	4.6	15.2	393	39

The sex ratios for both species of fleas differ on the two kinds of rats. Roof rats have fewer male fleas than do Norway rats (table 4). The explanation may be that when fleas leave the rats, they gravitate toward the floor and, assuming that male fleas spend less time on rats than do female fleas, then there should be fewer male fleas in the upper parts of buildings. Therefore, roof rats should have a smaller proportion of male fleas than do Norway rats, as is the case. Since *L. segnis* is collected only in the cold months, it is obvious that more female fleas will be found on the rats.

Table 5. *The percentage of females of two species of fleas by seasons*

Months 1944–45	*Xenopsylla cheopis*				*Leptopsylla segnis*			
	Roof rats		Norway rats		Roof rats		Norway rats	
	Fleas	Percent females	Fleas	Percent females	Fleas	Percent females	Fleas	Percent females
May–June	79	66.0	471	43 7	7	----------	139	51 7
July–August	267	54.3	579	46 4	0	----------	1	----------
September–October	80	48.8	126	36.9	0	----------	1	----------
November	18	50.0	4	----------	3	----------	39	71.7
December–January–February	83	53.0	95	63.2	128	69.5	21	66.6
March–April	166	66.3	430	63.6	283	64.0	964	67.8
May–June	302	49.0	438	47.4	37	67.5	41	63.4
July–August	426	51.4	779	46.9	0	----------	0	----------
September–October	62	45.2	556	45.7	8	----------	3	----------

Observations on Mites

The following observations on mites are included in order to add to our knowledge of the ectoparasites of rats. *Liponyssus bacoti,* the tropical rat mite, the most common mite in San Antonio, is at no time as common as are fleas. *Laelaps nuttali* is present in fair abundance; possibly some individuals of *Eulaelaps stabularis* are included in these totals because of misidentification. *Echinolaelaps echidninus* is a rare species. Frequently, the mites may occur in great numbers on a rat. If the rat has any mites, it usually has either very few or very many.

The population changes are grouped in accordance with the seasons (tables 6 and 7). The peak in numbers of *L. bacoti* is in March and April and the minimum occurs in July and August. Some individuals are present in all months of the year. *Laelaps* in contrast, reaches maximum abundance in July and August and a minimum in the winter months, although it is not common at any time. The few *Echinolaelaps echidninus* were found principally in the spring.

The roof rats appear to have more *L. bacoti* than do the Norway rats. In contrast *Laelaps* is more common on Norway rats than on roof rats (tables 6 and 7). There is no consistent difference between the number of mites found on immature and on adult rats.

Observations on Lice

The rat louse, *Polyplax spinulosa,* was frequently present on rats and sometimes in large numbers. When present in numbers, many hundred or even more than a thousand lice could be collected. One Norway rat was gray in color because of the large number of lice and nits. In these investigations an arbitrary total of 50 was recorded when lice were abundant, because the task of collection and counting was tremendous. Hence the data have limited usefulness.

Table 6. *Seasonal changes in abundance of* Liponyssus bacoti *(1944–45)*

	May-June			July-August			September-October			November		
	Rats	Mean	Per-cent	Rats	Mean	Per-cent	Rats	Mean	Per-cent	Rats	Mean	Per-cent
Roof rats:												
Adults	4	------	------	27	0 1	7	15	3 9	60	12	5.7	83
Immature	8	0 9	38	32	.3	12	29	1 2	.4	27	3 8	59
Norway rats:												
Adults	22	4 1	32	44	.2	9	22	1.0	45	17	2 0	70
Immature	13	4.0	28	13	.6	39	17	4 2	35	4	------	-------

	December-January-February			March-April			May-June			July-August		
	Rats	Mean	Per-cent	Rats	Mean	Per-cent	Rats	Mean	Per-cent	Rats	Mean	Per-cent
Roof rats:												
Adults	49	10 0	80	62	14 6	80	12	18 0	66	18	1 0	28
Immature	59	8.7	75	75	12.9	80	57	3 8	60	43	1.3	44
Norway rats:												
Adults	26	3 3	46	60	10 0	85	19	7	31	65	.4	9
Immature	7	14.5	71	35	10.9	74	16	2.4	44	32	.1	6

Table 7. *Seasonal changes in abundance of* Laelaps nuttali *(1944–45)*

	May-June			July-August			September-October			November		
	Rats	Mean	Per-cent	Rats	Mean	Per-cent	Rats	Mean	Per-cent	Rats	Mean	Per-cent
Roof rats:												
Adults	4	------	------	27	0	0	15	0.1	7	12	0	0
Immature	8	0 1	12	32	.2	6	29	1	10	27	.2	18
Norway rats:												
Adults	22	.2	9	44	.1	7	22	.5	23	17	5	23
Immature	13	.5	28	13	1.1	15	17	.2	17	4	------	-------

	December-January-February			March-April			May-June			July-August		
	Rats	Mean	Per-cent	Rats	Mean	Per-cent	Rats	Mean	Per-cent	Rats	Mean	Per-cent
Roof rats:												
Adults	49	0.6	4	62	0 1	2	12	0	0	18	0 1	6
Immature	59	.1	7	75	.1	8	57	.1	2	43	.1	4
Norway rats:												
Adults	26	.1	11	60	.3	16	19	0	0	65	1.7	37
Immature	7	0	0	35	.3	15	16	.4	19	32	1.7	40

The abundance is recorded according to seasons (table 8). The maximum occurs in the winter season and the minimum in the summer, but lice are present at all seasons. Norway rats have more lice than do roof rats, as shown by the total percentage calculated from the seasonal percentages in order to take account of different numbers of rats in each season.

Interrelations of Rats, Fleas, and Typhus

The differences in seasonal abundance of the various species of ectoparasites are such that there is considerable overlapping and

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at no time does the number of ectoparasites reach the vanishing point. It will be seen that the maximum abundance of fleas begins in May and lasts till August (tables 1 and 2). This increase is 2 months before the maximum number of typhus cases is noted in humans in San Antonio. (Table 9, compiled from the Weekly Morbidity Reports, shows the trend of cases in San Antonio by 4-week periods for 1944.) This lag seems to be more than would be expected if the fleas are equally infected with typhus at all seasons of the year. It seems possible that in the spring the percent of fleas that are infected, as well as the number of fleas, is increasing.

Table 8. *Seasonal changes in abundance of lice*

Season	Species of rat	Rats combed	Percent of rats infested
May–June 1944	Roof	12	8
	Norway	38	71
July–August 1944	Roof	59	3
	Norway	57	10
September–October 1944	Roof	49	14
	Norway	39	31
November 1944	Roof	39	33
	Norway	20	30
December–January–February 1944–45	Norway	113	36
	Roof	33	73
March–April 1945	Roof	140	37
	Norway	94	30
May–June 1945	Roof	90	25
	Norway	35	37
July–August 1945	Roof	63	21
	Norway	89	33
Total	Roof	565	21.8
	Norway	405	39.4

These observations of seasonal abundance are obviously based upon the abundance of ectoparasites on rats which is the important point in enzootic studies. However, the relation between the number of ectoparasites on rats and the number in a building (absolute abundance) needs investigation. It is not known that the seasonal changes herein described represent the changes in absolute abundance in a building. Clarification of this problem would help to explain the persistence of typhus from year to year. Recent work (*9*) refers to this subject and it may be concluded that the increase in fleas on rats in the warm months is in part due to the greater frequency of feeding by the males.

The maintenance of murine typhus fever obviously depends primarily on the frequency of contacts among the rats and fleas. This frequency will depend upon the number of rats and upon the number of fleas on each rat. It is of considerable importance to know the threshold of flea abundance below which typhus cannot maintain itself. Some observations upon this problem have been made in San Antonio by analysis of complement fixation test results and flea indices. The numbers of ectoparasites found on "positive" and

"negative" rats are shown in table 10. It is clear that there is a difference in the numbers for positive and negative rats. This situation occurs in spite of the fact that typhus has occurred in nearly every building with rats.

Table 9. *Typhus cases reported in San Antonio, 1944*

Month	4-week period	Typhus cases	Month	4-week period	Typhus cases
January	1	2	July	8	20
February	2	2	August	9	11
March	3	2	September	10	14
April	4	3	October	11	17
May	5	4	November	12	6
June	6	3	December	13	5
June-July	7	5			

A comparison of the differences in the numbers of fleas on immature positive and immature negative rats with the numbers on the corresponding adults is of interest. By averaging the totals for both sexes, it is found that, in the Norway rat, the positive adults have 1.85 times as many fleas as the negative adults although the positive immature rats have only 1.37 times as many fleas as the negative immature rats. This is to be expected since immature rats may be living in heavily infested buildings but have not lived long enough to have become infected. A similar situation occurs in the roof rats. Studies of this type suffer the deficiency of comparing the numbers of fleas on rats at a time after the rat became infected and are hence only a suggestive relation.

Table 10. *Number of fleas found on "positive" and "negative" rats in San Antonio (1944–45)*

	Positive complement fixation test						Negative complement fixation test					
	Male			Female			Male			Female		
	Rats	Mean [1]	Percent [2]	Rats	Mean	Percent	Rats	Mean	Percent	Rats	Mean	Percent
Roof rats:												
Adults	28	4.4	64	34	4.4	62	37	2.6	73	68	2 2	65
Immature	4			29	5.7	83	83	3 9	51	84	2 7	57
Norway rats:												
Adults	43	13.3	84	53	10.5	76	57	7.5	74	53	5.2	66
Immature	20	15.3	95	23	9.2	87	37	6 5	84	35	11.4	86

[1] Mean number of fleas per rat.
[2] Percent of rats having fleas.

All surveys of presence of antibodies in rats are biased in favor of positive rats because typhus is more likely to be present where there are many rats and rats are more easily caught in such places. A survey of rats in places where rats are rare would be difficult but would probably show all negative rats.

Summary

Commensal rats were collected in San Antonio, Tex. from May 1944 to September 1945 and examined for ectoparosites.

The rat flea, *Xenopsylla cheopis*, is most abundant on rats from May to August. The mouse flea, *Leptopsylla segnis*, is most abundant in March and April and is almost absent in the summer. The chicken flea, *Echidnophaga gallinacea*, is frequently found and the northern rat flea, *Nosopsyllus fasciatus*, was present in small numbers in the spring. A few cat fleas (*Ctenocephalides* sp.) and human fleas (*Pulex irritans*) were collected. The maximum abundance of fleas occurs in the spring season, but because of overlapping of maxima for various species, fleas are abundant for almost 6 months.

Norway rats have more fleas than have roof rats. For adult rats of both species, the males had more fleas than the females. The number and sex ratios of fleas in stores, mills, and residences were very similar. For both *X. cheopis* and *L. segnis* a high sex ratio in favor of females occurred in the cool seasons.

The mite, *Liponyssus bacoti*, was most abundant in March and April. *Laelaps nuttali* was most abundant in July and August. A few *Echinolaelaps echidninus* were found in May and June.

The rat louse, *Polyplax spinulosa*, was most common from December to February.

Because of the overlapping of months of abundance, ectoparasites are present on rats in all months of the year. The increase in human typhus cases lags about 2 months behind the increase in flea abundance. Rats positive for typhus have more fleas than have rats negative for typhus.

REFERENCES

(*1*) Davis, David E., and Pollard, Morris: The distribution of murine typhus in rats and in humans in San Antonio. Am. J. Trop. Med. **26:** 619–624 (1946).

(*2*) Davis, David E., and Pollard, Morris. Prevalence of typhus complement-fixing antibodies in human serums in San Antonio, Tex. Pub. Health Rep. **61:** 928–931 (1946).

(*3*) Davis, David E.: The control of rat fleas (*Xenopsylla cheopis*) by DDT. Pub. Health Rep. **60:** 485–489 (1945).

(*4*) Davis, David E.: The use of DDT to control murine typhus fever in San Antonio, Tex. Pub. Health Rep. **62:** 449–463 (1947).

(*5*) Davis, David E.: Observations on rats and typhus in San Antonio, Tex. Pub. Health Rep. **63:** 783–790 (1948).

(*6*) Mohr, Carl O.: Results of cooperative State-Federal typhus control programs. CDC Bull. **9:** 1–5 (1950).

(*7*) Hill, Elmer L., and Ingraham, S. C.: A study of murine typhus fever in Coffee County, Alabama. Pub. Health Rep. **62:** 875–881 (1947).

(*8*) Rumreich, A. S., and Koepke, J. A.: Epidemiological significance of seasonal variations in rodent-ectoparasite distribution. Pub. Health Rep. **60:** 1421–1428 (1945).

(*9*) Cole, L. C.: The effect of temperature on the sex ratio of *Xenopsytta cheopis* recovered from live rats. Pub. Health Rep. **60:** 1337–1342 (1945).

Use of Warfarin-Treated Oats as a Plague Suppressive Measure in Hawaii

By Bertram Gross, Robert H. Baker, and David D. Bonnet*

The rodenticidal possibilities of warfarin-treated oats under Hawaiian field conditions were investigated by Doty (*1*) in three tests conducted on the island of Kauai. The results of these field tests showed that warfarin was readily accepted by rodents in this form and that the period of exposure in bait stations should be at least 17 days or until consumption reaches zero. Doty concluded that warfarin had a place in the over-all plantation field program. He suggested that a system using lines of fairly permanent poison-bait stations along gulches and wasteland, where migration is more or less continuous, would be very effective.

Eskey (*2*) pointed out that *Rattus hawaiiensis* undoubtedly plays an important role in maintaining the endemic rural type of rodent plague which is present in Hawaii. The determination of the value of warfarin-treated oats as an additional plague suppressive measure in field areas where large numbers of *R. hawaiiensis* were present became, therefore, a matter of considerable interest and importance to plague control workers in the Territory of Hawaii.

To evaluate this problem in a known endemic plague region in Hawaii, a field experiment was undertaken to find out what effect the continuous application of warfarin-treated oats, over an extended period of time, would have on the rodent population of a limited area.

The area selected for this purpose, field 109, is located in plague work zone 3A, Hamakua, Hawaii. This field (fig. 1) was chosen because reports received from plantation field workers indicated that rats had been causing severe cane damage, and the Bureau of Rodent Control trapping records showed that a high rodent population was present.

Approximately 78 acres of this land are utilized by the Honokaa Sugar Company to cultivate sugar cane. At the time the experiment was initiated, the sections under cultivation were covered with a dense growth of mature cane (variety 32–8560) which was 17 months old and was scheduled to be harvested in a few months. The remainder of the area, approximately 60 acres, was not under cultivation. In these wasteland sections many species of fruit trees, shrubs, and grasses are found, several of which, in addition to sugar cane, may serve at one time or another as a source of rodent food supply.

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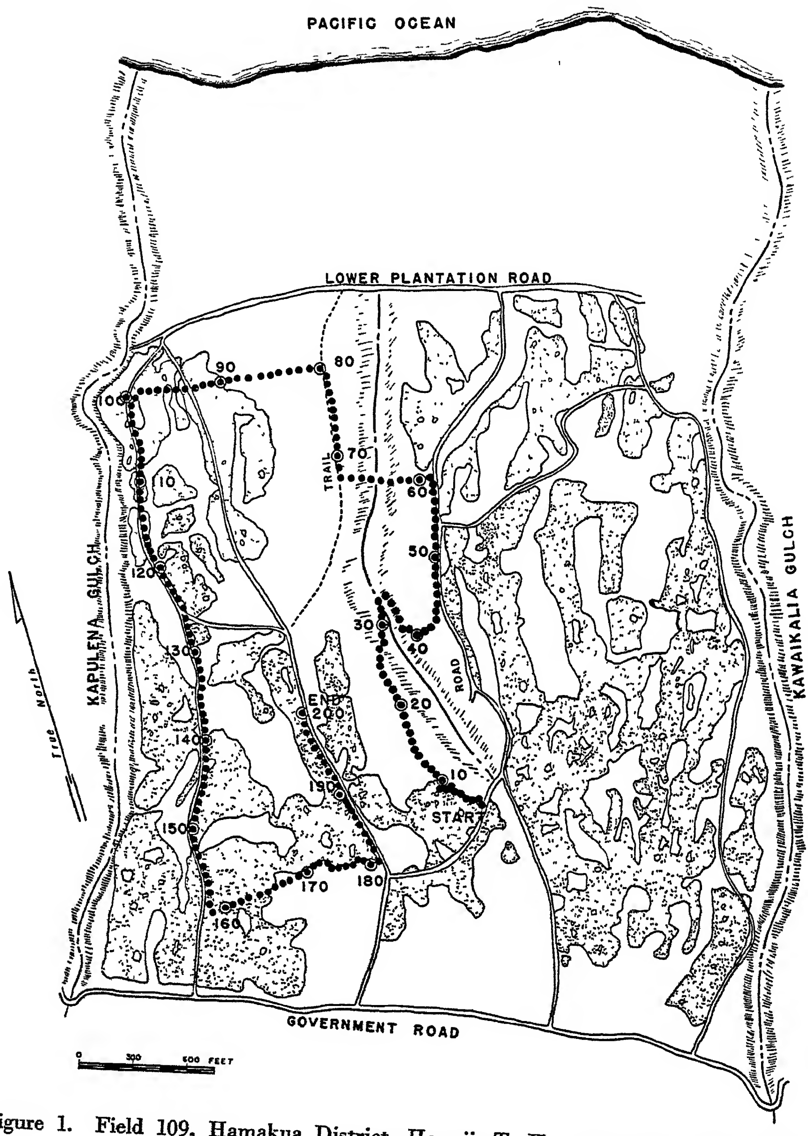

Figure 1. Field 109, Hamakua District, Hawaii, T. H., selected for rodenticidal experiment.

Many rock piles and a few rock walls are scattered throughout the wasteland sections. The experiment began February 3, 1951, and ended June 8, 1951.

Methods

To obtain a relative measurement of the rodent population, 200 numbered snap traps baited with coconut squares were set at intervals

of 35 to 50 feet throughout the area. These traps were serviced each working day, and records were kept of the rodent catch by individual station. At the end of a 1-week period the traps were removed and portable bait stations were substituted. These stations consisted of empty sardine cans (6½ x 4¼ x 1½ inches) and a numbered, curved covering hood (12 x 13 inches) similar to that described by Doty (*3*).

Unpoisoned oats were not used at any time during this experiment. When the poison stations were first distributed, 4 ounces by weight of warfarin-treated oats [1] were placed in each bait pan. Thereafter, all stations were checked at 3-to 5-day intervals. The presence of fecal pellets, blood stains, and dead rats was noted, and bait consumption was recorded. The bait supply was replenished up to 4 ounces whenever indicated. This poisoning phase of the test was carried on for 91 consecutive days. At the end of this time the poison stations were replaced with snap traps. Snap trapping was continued for 4 weeks to obtain data that could be compared with pretrapping data. Unfortunately post-trapping activities could not be conducted over a longer period of time as field 109 was harvested a few days later.

Results

The total number of rodents retrieved during the pre-poisoning period show that field 109 was heavily infested (table 1). In addition, the trapping data indicate that *R. alexandrinus* was the predominant species of rat present in the area, that large numbers of *R. hawaiiensis* were also present, that *R. norvegicus* and *R. rattus* were less abundant, and that approximately half (47.9 percent) of the rodents found in the area were mice.

When the warfarin-treated oats were exposed, many stations became active within a few days (table 2). Throughout the poisoning

Table 1. *Species composition of trapped rodents*

Species	Pre-poisoning period: First week, Number trapped	Pre-poisoning period: First week, Percent	Post-poisoning period [1]: First week, Number trapped	First week, Percent	Second week, Number trapped	Second week, Percent	Third week, Number trapped	Third week, Percent	Fourth week, Number trapped	Fourth week, Percent
R. alexandrinus	76	24.28	4	4.26	7	4.93	3	2.78	7	4.14
R. rattus	8	2.56	0	0	0	0	0	0	0	0
R. norvegicus	21	6.71	2	2.13	0	0	5	4.63	4	2.37
R. hawaiiensis	58	18.53	82	87.23	111	78.17	73	67.59	120	71.00
Total Rats	163	52.08	88	93.62	118	83.10	81	75.00	131	77.51
M. musculus	150	47.92	6	6.38	24	16.90	27	25.00	38	22.49
Total Rodents	313	100.00	94	100 00	142	100.00	108	100.00	169	100.00

[1] Warfarin-treated rolled oats exposed for 91 consecutive days.

[1] The poisoned oats consisted of a commercial product, prepared according to the formula of Doty, and contained by weight 0.025 percent warfarin, 11.0 percent mineral oil, 0.25 percent para-nitro-phenol (a mold deterrent), and 88.73 percent rolled oats.

Table 2. *Average daily consumption of warfarin-treated oats*

[200 bait stations]

Interval (days)	Number stations showing some acceptance	Percent stations showing some acceptance	Total bait consumed (gm.)	Average daily consumption (gm.)
4	145	72.5	3,997	999
3	159	79.5	7,002	2,334
3	185	92 5	9,830	3,277
4	162	81.0	6,790	1,698
3	131	65.5	3,352	1,117
4	154	77 0	5,401	1,350
3	135	67.5	4,132	1,377
4	131	65.5	4,061	1,015
3	160	80.0	4,210	1,403
4	135	67.5	4,387	1,097
3	139	69.5	4,097	1,366
3	101	50.5	2,814	938
5	169	84 5	7,258	1,452
3	131	65.5	3,558	1,186
3	151	75.5	3,877	1,292
4	161	80.5	5,705	1,426
3	122	61.0	3,622	1,207
4	149	74.5	5,521	1,380
3	138	69.0	4,897	1,632
4	175	87.5	7,655	1,914
3	146	73 0	4,486	1,495
4	171	85.5	8,115	2,029
3	170	85.0	6,350	2,117
4	154	77.0	7,782	1,946
3	150	75 0	6,081	2,027
4	185	92.5	8,455	2,114

phase, 316 pounds of the bait were consumed, and a high percentage of the stations continued to remain active. During this period, rodent droppings were observed in the bait pans on 549 different occasions. In addition, blood-stained oats were noted 28 times, and 11 rodents, showing signs of having consumed the poisoned grain, were found dead in, or immediately adjacent to, the stations. There was no evidence that any animal except rodents consumed the bait.

The average daily total consumption of the warfarin-treated oats remained at a low level for the first 4 days of exposure (fig. 2). During the following 6 days, consumption rose sharply. The two subsequent recordings, covering a period of 7 days, show that there was a sharp decline in the amount of poison bait eaten. At this time (17 days), the average daily total consumption of bait was 1,117 grams. Thereafter, the consumption curve showed a series of fluctuations with a gradual upward trend, indicating that large numbers of rodents were still present in the test area.

Examination of the results obtained during the post-trapping period shows that a radical change had occurred in the species composition of the rodents present in the area. The first week, there were marked reductions in the numbers of trapped *R. alexandrinus*, *R. rattus*, *R. norvegicus* and *M. musculus*. In contrast, the number of trapped *R. hawaiiensis* increased. Results obtained for the succeeding 3 weeks show that the species composition of the rats in the area remained relatively the same. The number of mice retrieved during this period showed a gradual increase. These data

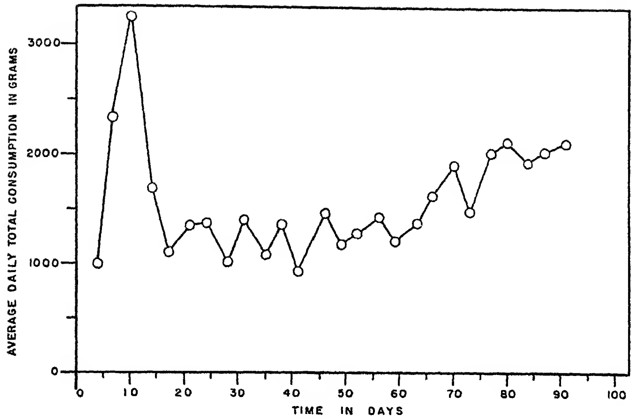

Figure 2. Consumption of warfarin-treated oats at 200 bait stations, field 109, Hamakua District, Hawaii, T. H., February 9 to May 11, 1951.

indicate clearly that the application of warfarin-treated oats resulted in control of all rodent species present except the native Hawaiian rat, *R. hawaiiensis*.

Discussion

Results of cage tests undertaken in Honolulu approximately 6 weeks after the Hamakua field experiment had begun, demonstrated that *R. hawaiiensis* accept warfarin-treated oats and die from the effects (see article following). The poison mix utilized for these cage tests was identical with that offered in the field experiment. The cage-test animals, however, did not have an extensive choice of food.

All species of rodents which were present in the field test area had a multiple choice of foods. After the poison bait was distributed, undoubtedly many of these rodents continued to feed to some extent on the various types of food normally available to them. As effective control of *R. alexandrinus*, *R. rattus*, *R. norvegicus*, and *M. musculus* was achieved through the use of warfarin-treated oats, it is apparent that most of these rodents also found the poison bait attractive and ingested quantities which eventually killed them.

The daily consumption of poison bait continued to remain at a high level throughout the poisoning period, indicating that *R. hawaiiensis* was also feeding on the warfarin mix. This conclusion is supported by the fact that 59.8 percent of the *R. hawaiiensis* rats trapped during the first week of the post-poisoning period showed evidence of hemorrhage on autopsy. Since the Hawaiian rat was not controlled effectively, it is not unlikely that this species fed sporadically on the warfarin-treated oats but did not consistently ingest sufficient quantities to produce death.

It is quite possible that the failure of the warfarin preparation to

control *R. hawaiiensis* is related to the question of food preferences. In the field, *R. hawaiiensis* may be more selective in its choice of foods than the other species of rodents. In addition, this species may consistently prefer a greater variety of foods. These speculations indicate the desirability of conducting further investigations to determine the food preferences of *R. hawaiiensis*.

Another possibility is that the *R. hawaiiensis* population was not controlled because of extensive migrations from adjacent areas. However, if one assumes this, it is difficult to explain why the other species of rodents were so drastically reduced. Perhaps the increase in the number of *R. hawaiiensis* was partially related to the radical decrease in the number of the *R. alexandrinus*, *R. rattus* and *R. norvegicus*. Since these species are larger and undoubtedly compete with the Hawaiian rat, it is not improbable that a reduction in their numbers would result in *R. hawaiiensis* being subjected to less biological pressure, thereby giving this species a much greater chance of survival. This would apply to both *R. hawaiiensis* present in the area and to those migrating into it. The younger rats of this species would be benefited particularly by such conditions.

R. hawaiiensis is primarily a field rodent and prefers to live in rock piles or in thickly vegetated areas. It is timid and rarely infests human habitations. The other species of rodents are also found in the fields. However, they are more aggressive and occasionally infest buildings where they and their fleas come into intimate contact with people. In the communities, therefore, *R. alexandrinus*, *R. rattus*, *R. norvegicus*, and *M. musculus* are more directly implicated in the transmission of plague to humans than is *R. hawaiiensis*.

As previously noted, warfarin-treated oats effectively controlled all species of rodents in the test area except *R. hawaiiensis*. It is probable, therefore, that the extensive application of this rodenticide in field areas and in communities might have considerable value as a means of reducing the plague potential for the entire endemic region. However, large numbers of *R. hawaiiensis* are found in all areas of the plague district and plague infection is detected more often in this species than in any other rodent present. Thus, *R. hawaiiensis* and its ectoparasites would continue to be the reservoir of plague infection in the cane fields and wastelands.

The important role played by *R. hawaiiensis* in the epidemiology of plague in Hawaii focuses attention on the necessity of conducting additional laboratory and large-scale field tests to determine a suitable warfarin bait which will effectively control this species.

Summary

1. The purpose of this experiment was to determine the value of warfarin-treated oats as an additional plague suppressive measure

in field areas in Hawaii where large numbers of *Rattus hawaiiensis* were present.

2. The test was conducted in a sugar cane field located in the endemic plague region of the Hamakua District, island of Hawaii, T. H.

3. Trapping results obtained before warfarin-treated oats were exposed show that this field was heavily infested with rodents. The results indicated that *R. alexandrinus* was the predominant species of rat present in the area, that large numbers of *R. hawaiiensis* were also present, that *R. norvegicus* and *R. rattus* were less abundant and that approximately half (47.9 percent) of the rodents found in the area were *M. musculus*.

4. Warfarin-treated oats were exposed continuously at 200 bait stations for a period of 91 days. During this time 316 pounds of bait were consumed, and a high percentage of the stations remained consistently active, indicating that large numbers of rodents were still present in the test area.

5. Trapping results obtained immediately after poisoning activities showed that a radical change had occurred in the species composition of the rodents present in the area. There were marked reductions in the numbers of *R. alexandrinus, R. rattus, R. norvegicus*, and *M. musculus*. In contrast, the number of trapped *R. hawaiiensis* increased.

6. The data indicate clearly that the application of warfarin-treated oats resulted in control of all rodent species present except the native Hawaiian rat, *R. hawaiiensis*.

7. The extensive application of warfarin-treated oats in field areas and communities to control *R. alexandrinus, R. rattus, R. norvegicus*, and *M. musculus* might have considerable value as a means of reducing the plague potential for the entire endemic region. However, *R. hawaiiensis* and its ectoparasites would continue to be the reservoir of plague infection in the fields. It is indicated, therefore, that a more suitable warfarin bait be found which will effectively control this species.

REFERENCES

(*1*) Doty, R. E.: Warfarin (Compound 42) A promising new rodenticide for cane fields. Hawaiian Planters' Rec. 54: 1–21 (1950).

(*2*) Eskey, C. R.: Epidemiological Study of Plague in the Hawaiian Islands. Public Health Bulletin No. 213, pp. 1–70 (1934).

(*3*) Doty, R. E.: Rat control on Hawaiian sugar cane plantations. Hawaiian Planters' Rec. 49: 74–239 (1945).

Cage Tests With Warfarin on the Hawaiian Rat, *Rattus hawaiiensis* Stone, and the House Mouse, *Mus musculus* Linn., in Hawaii

By David D. Bonnet, Edward S. C. Mau, and Bertram Gross*

A previous report by Doty (*1*) has given the results obtained with warfarin-treated rolled oats as a rodenticide in cage tests in Hawaii on *Rattus norvegicus* (Erxleben), *Rattus alexandrinus* (Geoffroy), and *Rattus rattus* Linn. This paper reports a similar series of tests undertaken in Honolulu, T. H. on the Hawaiian rat, *Rattus hawaiiensis* Stone, and the house mouse, *Mus musculus* Linn. Data on the effectiveness of warfarin-treated rolled oats against these two additional species were particularly desired because an extensive field experiment in which this poison bait was used was already in progress in a rural plague area, where large numbers of both species were known to be present (see preceding report in this issue).

Rats and mice were captured during March and April 1951 near Honolulu, in live cage traps baited with squares of coconut meat. They were transferred to individual cages and provided with unlimited drinking water and pieces of coconut. Each cage contained nesting material and a suitable shelter. A record was made of the species, sex, and weight of each rodent.

Tared petri dishes containing weighed quantities of rolled oats were placed in the cages each day. These dishes and their contents were reweighed on each subsequent day and the amount consumed was determined by difference. Unpoisoned rolled oats were presented for approximately seven consecutive days, after which poisoned oats were substituted. Preliminary tests had demonstrated that a pretest period of 1 week was more than sufficient for the caged wild rodents to become accustomed to laboratory life and to consume regular amounts of food. The poisoned oats consisted of a commercial product, prepared according to the formula of Doty, and contained by weight 0.025 percent warfarin, 11.0 percent mineral oil, 0.25 percent para-nitro-phenol (a mold deterrent), and 88.73 percent rolled oats.

*Medical Entomologist, former Supervising Rodent Control Inspector, Oahu, and Chief, Bureau of Rodent Control, respectively, Division of Sanitation, Department of Health, Territory of Hawaii.

Note: 3 (alpha-phenyl-beta-acetyl ethyl)-4-hydroxycoumarin, or warfarin, is a chemical discovered, by Dr. K. P. Link and associates of the Wisconsin Alumni Research Foundation, to have lethal anti-coagulant properties in mammals.

Results

A summary of the results obtained is presented in the table. There was a difference in the quantity of food eaten by the male and female rats, but when calculated on a body weight basis, the difference was not significant. The poisoned oats were not quite as acceptable as unpoisoned oats, since the daily food consumption dropped significantly on the first 2 days after presentation of the poison. After the second day there was an even further drop in consumption (fig. 1), probably indicating that the poison was beginning to take effect. The increased daily consumption as shown in figure 1 after the sixth day is the result of consumption by those animals which lived beyond the mean day of death (7.9 days). The animals in this group, constituting 50 percent of the population, ate a smaller quantity of warfarin oats (4.9 gm.) during the first 2 days of the experiment, and were still consuming small quantities of poisoned bait at the same time that early mortalities were eliminating a portion of the population. Therefore, the food consumption, as percent of body weight, is warped and indicates an artificial increase which is not significant. This avoidance of the poisoned bait by some individuals may account in part for the longer survival of this group.

The mean day of death (7.9) is somewhat greater in *R. hawaiiensis* than that reported by Doty for the other species of rodents found in Hawaii (*R. norvegicus*, 5.4 days; *R. rattus*, 5.8 days; and *R. alexandrinus*, 6.8 days). This would appear to indicate a greater resistance of *R. hawaiiensis* to the effects of the poison. However,

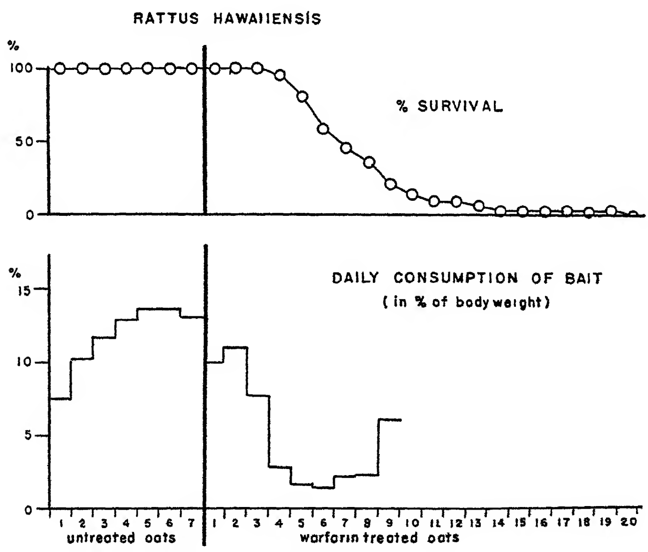

Figure 1. Consumption of warfarin-treated oats by *R. hawaiiensis*.

the amount of poisoned oats ingested by this species in percentage of body weight was 38.9±1.3 percent. This quantity is not significantly different from the amounts ingested by *R. alexandrinus* in Doty's tests. None of the animals in this series refused to accept the warfarin-poisoned oats, and all died from the effects.

Results of cage tests with warfarin, in Hawaii, March and April 1951

Item	*Rattus hawaiiensis*	*Mus musculus*
Number	42	15.
Total body weight	2,313.8 gm.	198.2 gm.
Mean body weight	55.1±1.2 gm.	13.2±1.0 gm.
Mean daily consumption of unpoisoned rolled oats	7.1±0.2 gm.	2.3±0 3 gm.
Mean daily consumption as percent of body weight	12.9±0.8 percent	17.4±3.0 percent.
Total warfarin-oats eaten	899.0 gm.	143 0 gm.
Mean daily consumption of warfarin-poisoned oats on 1st and 2d day of presentation.	5.6±0.2 gm.	1.4±0.4 gm.
Total warfarin-oats as percent of total body weight	38.9±1.3 percent	72.2±6.5 percent.
Mean day of death	7.9±0.5 days	8.6±1.0 days.

The earliest that death occurred was 4 days after the initial presentation of poison. The maximum survival was 20 days. By the eleventh day, 90 percent of the experimental animals had succumbed to the effects of warfarin.

Autopsies were performed on all animals after death, and hemorrhages were found in various organs of the body, including the heart,

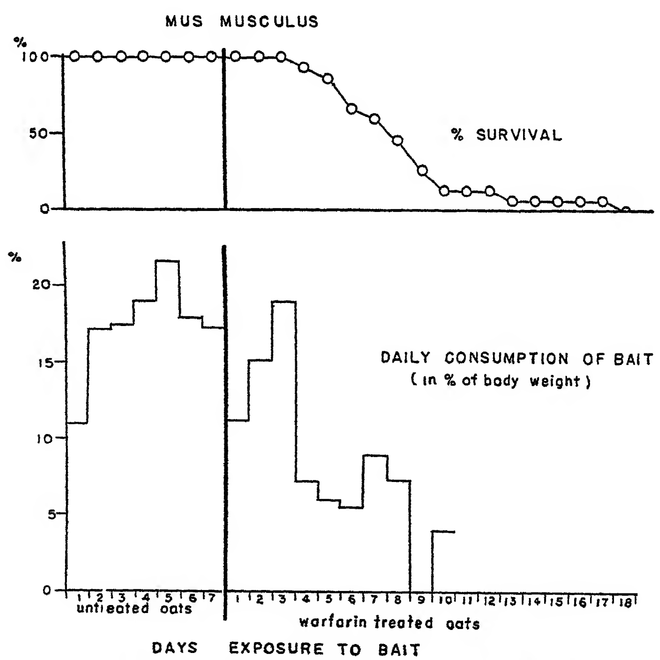

Figure 2. Consumption of warfarin treated oats by *M. musculus*.

lungs, mesenteries, brain, skin, muscles, and genitourinary systems. In most instances, more than one system was involved. It is noteworthy, however, that 69 percent of the rats showed extensive hemorrhages in the pectoral-cervical region. Hayes and Gaines (*2*) have stated that for the white rat the perioesophageal and cervical bleeding was possibly the result of mild experimental trauma due to stomach tube application of the poison. Our results indicate that in *R. hawaiiensis* cervical involvement occurs naturally and with high frequency.

As would be expected in a smaller animal, the food consumption of mice in terms of percentage of body weight, was greater than that found in the rats (fig. 2). The mean day of death for *Mus musculus* was 8.6 days, which is significantly greater than that found for *Rattus hawaiiensis* or for the three species tested by Doty. The ingestion of warfarin by mice continued for a longer period and resulted in a high consumption of poisoned rolled oats (72.2 ± 6.5 percent) when computed in terms of percentage of body weight. Ninety percent of the mice were dead as a result of the poison by the end of the thirteenth day. The earliest death occurred on the fourth day, and the maximum survival of any individual mouse was 17 days.

REFERENCES

(*1*) Doty, R. E.: Warfarin (Compound 42) A promising new rodenticide for cane fields. Hawaiian Planters' Rec. **54:** 1–21 (1950).

(*2*) Hayes, Wayland J., Jr., and Gaines, Thomas B.: Control of Norway rats with residual rodenticide warfarin. Pub. Health Rep. **65:** 1537–1555. (1950).

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

Announcement

A New *Morbidity and Mortality Weekly Report*

The new monthly PUBLIC HEALTH REPORTS (see back cover) will publish from time to time, as appropriate, reports, tabulations, and articles dealing with morbidity statistics, both domestic and foreign. The present weekly "Incidence of Disease" section, however, will be discontinued as of December 31, 1951.

Current provisional morbidity data on notifiable diseases for the United States now appear in summary form and in tabulations by States and cities in the *Weekly Morbidity Report* issued by the National Office of Vital Statistics of the Public Health Service. Beginning on January 11, 1952, the Public Health Service through the National Office of Vital Statistics will issue a *Morbidity and Mortality Weekly Report* presenting these morbidity data as well as certain mortality data for selected cities.

Libraries and agencies that have depended upon PUBLIC HEALTH REPORTS for current morbidity statistics for the United States may continue to receive the same data by writing to the National Office of Vital Statistics, Public Health Service, Washington 25, D. C., requesting that they be placed on the mailing list for the new *Morbidity and Mortality Weekly Report.* Individuals who wish to be placed on the mailing list should indicate how and to what extent they will make use of this publication.

Since the *Weekly Epidemiological Record* and other publications of the World Health Organization, Geneva, Switzerland, contain morbidity data for foreign countries, tabulations of notifiable diseases occurring outside the United States and its Territories will not appear regularly in National Office of Vital Statistics publications.

UNITED STATES

Reports from States for Week Ended December 8, 1951

The incidence of measles declined slightly for the current week as compared with the previous week but was about 66 percent higher than for the same week in 1950. The greatest concentration of cases continues to be in the northeastern section of the country.

The number of cases of scarlet fever (1,530) for the current week is about 30 percent higher than for the same week last year. The 5-year median is 1,837.

A slight decrease in poliomyelitis cases was reported. The cumulative total for the calendar year is now 27,975 as compared with

32,473 for the same period in 1950. The cumulative total since the seasonal low week is 26,757 as compared with 31,342 in 1950.

Diphtheria incidence was lower for the current week than for the same week last year. The disease continues to be concentrated in the southern States.

Two cases were erroneously reported as smallpox in Nebraska last week because of a clerical error. They were cases of chickenpox.

Nine cases of rabies in animals were erroneously reported for New Jersey for the week ended November 24 because of an error in transmitting the report.

One case of leprosy was reported by Minnesota.

Only eight cases of malaria in civilians were reported, two in New York and six in Texas. The number from military establishments was also smaller as compared with previous weeks.

Epidemiological Reports

Gastroenteritis

Dr. J. P. Ward, Arizona Director of Public Health, has reported an outbreak of gastroenteritis consisting of 40 cases which occurred at a church social. All food stuffs served at the meal were examined bacteriologically and *Staphylococcus* was isolated from a sample of cole slaw. Mayonnaise was suspected of containing the organism and improper refrigeration was thought to be a contributing factor.

Dr. H. W. Stevens, Massachusetts district health officer, has reported an outbreak of gastroenteritis caused by *Salmonella montevideo*. Nine cases occurred after an incubation period of 18 to 24 hours following the eating of chocolate eclairs. The illness lasted from 1 to 2 weeks. Because of a marked delay in reporting the cases, investigation of the bakery where the eclairs were prepared, and of its personnel, did not reveal the source of infection.

S. V. Dugan, Kentucky Department of Health, has reported an outbreak of gastroenteritis in a public school which presumably followed the eating of wieners in the cafeteria. About 45 to 50 pupils out of a total of 98 who ate in the cafeteria became ill after an incubation period of 3 to 10 hours. A sample of uncooked wieners, when examined in the laboratory, showed the presence of a weakly hemolytic alpha prime type *Streptococcus*. Fifty grams of the sample fed to a kitten caused marked diarrhea 24 hours later.

Reports have been received that construction workers and other personnel on a project in Nevada were affected twice within 2 weeks by outbreaks of gastroenteritis, presumably food-borne. Sixty persons were affected in the first and 100 or more in the second instance. Some article of food in box lunches, which included meat sandwiches, is suspected of being the vehicle of infection.

Rabies in Animals

Rabies has been reported in a number of species of animals over the past few months in South Dakota. Prior to 1951, no cases in animals had been observed for about 13 years. Since the disease appeared in April 1951, laboratory confirmation has been obtained on the following species of animals: dogs, cats, skunks, muskrats, squirrels, rats, and mice. The infection has been found more frequently in skunks than in dogs or other domestic animals.

Psittacosis

Dr. Albert Milzer, Collaborating Laboratory of the Influenza Study Program, has reported a complement fixation titer of 1 to 64 in acute phase serum, and 1 to 256 in convalescent serum for the psittacosis-pneumonitis group in a woman who owns a pet shop in Chicago. The patient who sells parrots and parakeets had clinical findings of an atypical pneumonia and responded successfully to aureomycin therapy.

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Dec. 8, 1951	Dec. 9, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	------	1	1	(1)	(1)	(1)	(1)	57	43	48
Diphtheria (055)	90	132	220	27th	1, 910	2, 573	4, 518	3, 918	5, 701	9, 129
Encephalitis, acute infectious (082)	26	20	11	(1)	(1)	(1)	(1)	999	953	608
Influenza (480–483)	1, 695	1, 210	1, 210	30th	8, 045	11, 097	11, 097	124, 100	149, 864	139, 295
Measles (085)	6, 059	3, 008	3, 008	35th	31, 341	18, 254	18, 238	500, 252	306, 425	584, 626
Meningitis, meningococcal (057. 0)	76	80	69	37th	804	741	709	3, 865	3, 540	3, 253
Pneumonia (490–493)	1, 089	1, 551	(2)	(1)	(1)	(1)	(1)	56, 221	76, 282	(2)
Poliomyelitis, acute (080)	378	480	322	11th	[3] 26, 763	31, 342	26, 666	[3] 27, 975	32, 473	27, 016
Rocky Mountain spotted fever (104)	------	1	1	(1)	(1)	(1)	(1)	328	452	558
Scarlet fever (050) [4]	1, 530	1, 194	1, 837	32d	11, 662	11, 673	15, 898	65, 048	51, 843	72, 259
Smallpox (084)	------	------	1	35th	[5] 1	11	11	[5] 12	37	53
Tularemia (059)	20	16	22	(1)	(1)	(1)	(1)	613	841	962
Typhoid and paratyphoid fever (040,041) [6]	53	54	51	11th	2, 553	2, 798	3, 238	2, 988	3, 307	3, 723
Whooping cough (056)	1, 502	1, 967	2, 227	39th	11, 286	16, 964	16, 964	65, 061	114, 159	93, 755

[1] Not computed. [2] Data not available. [3] Addition: Kentucky, 6 cases, delayed reports—not allocated. [4] Including cases reported as streptococcal sore throat. [5] Deduction: Nebraska, week ended Dec. 1, 2 cases. [6] Including cases reported as salmonellosis.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Dec. 8, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**90**	**26**	**1,695**	**6,059**	**76**	**1,089**	**378**
New England		**1**	**4**	**1,094**	**5**	**44**	**5**
Maine			2	129		9	1
New Hampshire				46	1	4	
Vermont				137			
Massachusetts		1		439			3
Rhode Island				91	3	1	
Connecticut			2	252	1	30	1
Middle Atlantic	**6**	**4**	**1**	**2,394**	**19**	**102**	**19**
New York	3	4	(1)	1,368	10		9
New Jersey			1	294		40	
Pennsylvania	3			732	9	62	10
East North Central	**19**	**9**	**5**	**1,035**	**14**	**94**	**46**
Ohio	9			230	5		11
Indiana	8	2		33			6
Illinois	1	3	3	306	3	78	6
Michigan	1	4	2	364	6	16	16
Wisconsin				102			7
West North Central	**7**	**1**	**7**	**129**	**5**	**212**	**36**
Minnesota			1	47	1	13	13
Iowa				7	1		2
Missouri	6		1	5	1		6
North Dakota		1	5	35		198	
South Dakota				9	1		1
Nebraska				16			4
Kansas	1			10	1	1	10
South Atlantic	**29**	**3**	**75**	**508**	**8**	**123**	**27**
Delaware				1			
Maryland	1		1	231		33	3
District of Columbia				31		17	1
Virginia	3	2		65	3	40	4
West Virginia	4	1		44	1		3
North Carolina	3			7	4		4
South Carolina	1		44	14		4	
Georgia	13		30	91		29	5
Florida	4			24			7
East South Central	**17**	**1**	**14**	**243**	**10**	**53**	**40**
Kentucky	2		2	168	3	2	5
Tennessee	1	1		44	5		5
Alabama	12			17	1	37	8
Mississippi	2		12	14	1	14	22
West South Central	**8**	**1**	**203**	**81**	**4**	**287**	**79**
Arkansas			97	15		31	13
Louisiana			1	1		31	7
Oklahoma	1		105	6	2	9	2
Texas	7	1		59	2	216	57
Mountain	**1**		**1,357**	**283**	**3**	**85**	**35**
Montana			25	41	1		2
Idaho	1			5			6
Wyoming				1		3	4
Colorado			1,117	24		20	5
New Mexico				10	1	1	1
Arizona			215	145		61	2
Utah				57	1		13
Nevada							2
Pacific	**3**	**6**	**29**	**292**	**8**	**89**	**91**
Washington	2		4	103	1	2	10
Oregon			13	14	2	39	6
California	1	6	12	175	5	48	75
Alaska		1					
Hawaii			32	784			

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Dec. 8, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever [1] (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [2] (040, 041)	Whooping cough (056)	Rabies in animals
United States		1,530		20	53	1,502	129
New England		85			4	200	
Maine		4				33	
New Hampshire		9				12	
Vermont		2				41	
Massachusetts		48			3	85	
Rhode Island		1				14	
Connecticut		21			1	15	
Middle Atlantic		258		1	4	216	7
New York		173			3	100	3
New Jersey		19				40	
Pennsylvania		66		1	1	76	4
East North Central		528		6	5	281	10
Ohio		151			1	100	4
Indiana		64		1	1	13	1
Illinois		99		2	1	29	2
Michigan		171		3	1	81	1
Wisconsin		43			1	58	2
West North Central		77		2		85	19
Minnesota		18		2		1	10
Iowa		5				6	4
Missouri		23				26	5
North Dakota		1				4	
South Dakota		3				2	
Nebraska		4				24	
Kansas		23				22	
South Atlantic		179		2	7	145	28
Delaware							
Maryland		32				9	
District of Columbia		13			1		
Virginia		23		1	2	24	3
West Virginia		17				67	2
North Carolina		69			1	14	12
South Carolina		2					3
Georgia		11		1	3	13	8
Florida		12				18	
East South Central		49		3	2	109	29
Kentucky		23		3		45	4
Tennessee		25				28	11
Alabama					1	32	6
Mississippi		1			1	4	8
West South Central		49		5	9	334	32
Arkansas		6		4	1	11	2
Louisiana		4				3	
Oklahoma		9		1	1	11	2
Texas		30			7	309	28
Mountain		50		1	3	40	
Montana		10				4	
Idaho		8				11	
Wyoming		1		1		2	
Colorado		7			1	17	
New Mexico		3			1	1	
Arizona		4			1	4	
Utah		12				1	
Nevada		5					
Pacific		255			19	92	4
Washington		20			1		
Oregon		29				8	
California		206			18	84	4
Alaska		1					
Hawaii					3		

[1] Including cases reported as streptococcal sore throat. [2] Including cases reported as salmonellosis.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Nov. 24, 1951

Disease	Total	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Brucellosis	2					2					
Chickenpox	1,228	6		33	4	189	508	56	95	185	152
Diphtheria	12					11				1	
Dysentery:											
Amebic	3					3					
Bacillary	3						3				
Encephalitis, infectious	1								1		
German measles	167			82		22	23		12	13	15
Influenza	16			12			2	1	1		
Measles	793	14			6	154	97	20	2	358	142
Meningitis, meningococcal	10					4			1	1	4
Mumps	718	1			2	130	388	38	47	60	52
Poliomyelitis	20			2		8	3		5	1	1
Scarlet fever	385				2	122	31	23	44	44	119
Tuberculosis (all forms)	271	33		10	2	123	23	35	10	12	23
Typhoid and paratyphoid fever	5					5					
Venereal diseases:											
Gonorrhea	301	6		3	3	74	57	26	33	41	58
Syphilis	68	5		5	1	36	10	2	1	1	7
Primary	6					3	1				2
Secondary	5					3	1			1	
Other	57	5		5	1	30	8	2	1		5
Other forms	1							1			
Whooping cough	257					116	60	16	15	32	18

MADAGASCAR

Reported Cases of Certain Diseases and Deaths—September 1951

Disease	Aliens		Native	
	Cases	Deaths	Cases	Deaths
Beriberi			1	
Bilharziasis			86	
Dysentery:				
Amebic	2		153	
Bacillary	2		21	
Diphtheria	1		9	
Erysipelas			6	
Influenza	2		3,388	13
Leprosy			24	
Malaria	103	2	24,824	113
Measles	2		229	4
Mumps			100	
Meningitis, meningococcal			6	3
Plague			25	20
Pneumonia (all forms)	4	1	691	70
Puerperal infection			8	1
Tuberculosis, respiratory	8	1	109	15
Typhoid fever			3	
Whooping cough	7		293	

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

Cholera

India. During the week ended December 1, cholera was reported as follows: Calcutta, 77 cases; and Madras, 8.

Pakistan. For the week ended December 1, 20 cases of cholera were reported in Dacca.

Plague

Madagascar. There were more cases (25) of plague reported during the period November 11–20 than for any previous 10-day period this year. Only 9 cases were reported for the period November 1–10.

Union of South Africa. One case of septicemic plague was reported during the week ended November 24, in the Bothaville District, Orange Free State.

Smallpox

Algeria. One case of smallpox was reported during the period October 21–31. This is the first case since August 21.

Burma. Smallpox was reported for the week ended December 1, as follows: Mergui, 27 cases; Moulmein, 2; and Rangoon, 1.

India. During the week ended December 1, smallpox was reported in ports of India as follows: Madras, 8 cases; Calcutta, 5; Bombay, 2; and Cawnpore, 1.

Indochina. The incidence of smallpox in Hanoi, Viet Nam, has increased from 33 cases reported for the week ended November 24, to 208 for the following week.

Yellow Fever

Gold Coast. The three cases of yellow fever reported in Suhum for the period August 2–9, were confirmed on November 30.

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It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Requests for and communications regarding the PUBLIC HEALTH REPORTS and reprints should be addressed to the Surgeon General, Public Health Service, Washington 25, D. C. Subscribers should remit direct to the Superintendent of Documents, Washington 25, D. C.

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Price 10 cents. Subscription price—per year $4.25, domestic; $5.00 foreign.

—Announcement—

PUBLIC HEALTH REPORTS

To be Published Monthly Next Year

Beginning in January 1952 PUBLIC HEALTH REPORTS will be published monthly. Two other technical publications of the Public Health Service—the Journal of Venereal Disease Information and the CDC Bulletin—are being merged with it.

The merger has come about as the result of an extended study of the Public Health Service's publishing activities. The new journal is designed to carry out more efficiently and economically the Public Health Service's responsibilities for disseminating scientific information on matters of health.

The new PUBLIC HEALTH REPORTS will be concerned with the technical and professional aspects of public health practice, with problems of health administration, and with research in these fields. It will include substantially the types of material that have been appearing in the three present journals and the monthly Tuberculosis Control Issue of PUBLIC HEALTH REPORTS. There will be more emphasis, however, on administrative practice, program development, and applied research aspects and less emphasis on bench research and clinical material not rather directly related to public health practice.

As has been true with each of the present journals, the pages of the new PUBLIC HEALTH REPORTS will be open, on merit, to any responsible author. General editorial guidance will be provided by a Board of Editors composed of individuals of recognized competence and professional stature drawn from both within and outside the Federal service.

Every effort will be made to furnish the new PUBLIC HEALTH REPORTS to representative organizations in public health and its related fields. Most of the readers on the mailing list are affiliated with organizations to which free distribution can legally be made. They will continue to receive the new journal either directly or through these organizations.

The first issue of the new PUBLIC HEALTH REPORTS and an application form for a free subscription will be sent to readers now on the free lists for technical periodicals. After they have had an opportunity to review the new PUBLIC HEALTH REPORTS and to consider its usefulness in their work, readers who wish to remain on the lists and receive the new periodical regularly should complete the application and send it in as soon as possible. This will allow time to revise the lists for mailing the second and subsequent issues.

The new PUBLIC HEALTH REPORTS will also be available by paid subscription from the Superintendent of Documents, Government Printing Office.

Public Health Reports

Issued Weekly by the
PUBLIC HEALTH SERVICE

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Volume 66—Part I

Nos. 1–26

January–June 1951

FEDERAL SECURITY AGENCY

PUBLIC HEALTH SERVICE

FEDERAL SECURITY AGENCY
Oscar R. Ewing, Administrator

PUBLIC HEALTH SERVICE
Leonard A. Scheele, Surgeon General

Division of Public Health Methods
G. St. J. Perrott, Chief of Division

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Public Health Reports

Issued Weekly by the
PUBLIC HEALTH SERVICE

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Volume 66—Part II

Nos. 27–52

July–December 1951

FEDERAL SECURITY AGENCY

PUBLIC HEALTH SERVICE

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